U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-246 313

# ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE PAVING AND ROOFING MATERIALS (TARS AND ASPHALT) INDUSTRY

ARTHUR D. LITTLE, INCORPORATED

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

NOVEMBER 1975

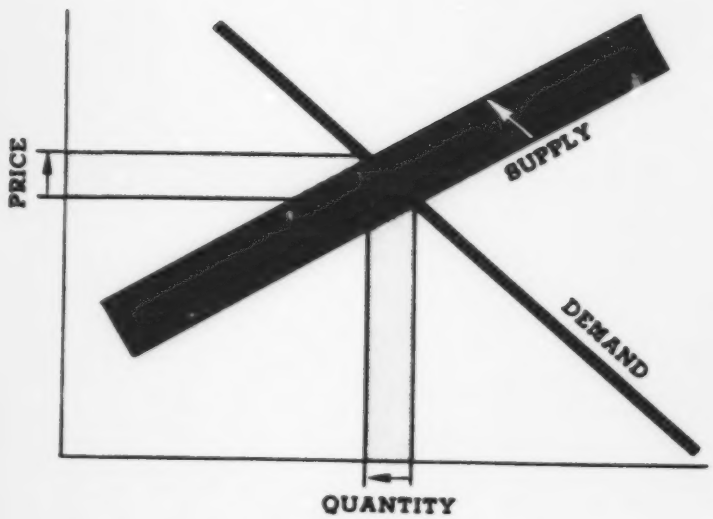
EPA-230/2-74-055

311158
PB 246 313

NOVEMBER 1975

# ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES

# PAVING AND ROOFING MATERIALS (Tars and Asphalt)




U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Planning and Evaluation
Washington, D.C. 20460

This document is available in limited quantities through Ruth Brown at the U.S. Environmental Protection Agency, Information Center, Room W-327 Waterside Mall, Washington, D.C. 20460

The document will subsequently be available through the National Technical Information Service, Springfield, Virginia 22151.

# KEEP UP TO DATE

Between the time you ordered this report—which is only one of the hundreds of thousands in the NTIS information collection available to you—and the time you are reading this message, several *new* reports relevant to your interests probably have entered the collection.

Subscribe to the **Weekly Government Abstracts** series that will bring you summaries of new reports *as soon as they are received by NTIS* from the originators of the research. The WGA's are an NTIS weekly newsletter service covering the most recent research findings in 25 areas of industrial, technological, and sociological interest—invaluable information for executives and professionals who must keep up to date.

The executive and professional information service provided by NTIS in the **Weekly Government Abstracts** newsletters will give you thorough and comprehensive coverage of government-conducted or sponsored research activities. And you'll get this important information within two weeks of the time it's released by originating agencies.

WGA newsletters are computer produced and electronically photocomposed to slash the time gap between the release of a report and its availability. You can learn about technical innovations immediately—and use them in the most meaningful and productive ways possible for your organization. Please request NTIS-PR-205/PCW for more information.

The weekly newsletter series will keep you current. But *learn what you have missed in the past* by ordering a computer **NTISearch** of all the research reports in your area of interest, dating as far back as 1964, if you wish. Please request NTIS-PR-186/PCN for more information.

WRITE: Managing Editor
5285 Port Royal Road
Springfield, VA 22161

# Keep Up To Date With SRIM

SRIM (Selected Research in Microfiche) provides you with regular, automatic distribution of the complete texts of NTIS research reports *only* in the subject areas you select. SRIM covers almost all Government research reports by subject area and/or the originating Federal or local government agency. You may subscribe by any category or subcategory of our WGA **(Weekly Government Abstracts)** or **Government Reports Announcements and Index** categories, or to the reports issued by a particular agency such as the Department of Defense, Federal Energy Administration, or Environmental Protection Agency. Other options that will give you greater selectivity are available on request.

The cost of SRIM service is only 45¢ domestic (60¢ foreign) for each complete microfiched report. Your SRIM service begins as soon as your order is received and processed and you will receive biweekly shipments thereafter. If you wish, your service will be backdated to furnish you microfiche of reports issued earlier.

Because of contractual arrangements with several Special Technology Groups, not all NTIS reports are distributed in the SRIM program. You will receive a notice in your microfiche shipments identifying the exceptionally priced reports not available through SRIM.

A deposit account with NTIS is required before this service can be initiated. If you have specific questions concerning this service, please call (703) 451-1558, or write NTIS, attention SRIM Product Manager.

This information product distributed by

NTIS U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

| TECHNICAL REPORT DATA PAGE | 1. Report No. EPA 230/2 - 74 - 055 | 2. | 3. Recipient's Accession No. |
|---|---|---|---|
| 4. Title and Subtitle: Economic Analysis of Effluent Guidelines - Paving and Roofing Materials Industries. (Tars & Asphalt) | | | 5. Report Date: November 1975<br>6. |
| 7. Author(s): Richard F. Goodale<br>Ronald Levy | | | 8. Performing Organization Rept. No. C-75928 |
| 9. Performing Organization Name and Address: Arthur D. Little, Inc.<br>Acorn Park<br>Cambridge, Massachusetts 02140 | | | 10. Project/Task/Work Unit No. Task Order No. 28<br>11. Contract/Grant No. 68-01-1541 |
| 12. Sponsoring Organization Name and Address: Office of Planning and Evaluation<br>Environmental Protection Agency<br>Washington, D. C. 20460 | | | 13. Type of Report & Period Covered: Final<br>14 |

15. Supplementary Notes

16. Abstracts

An analysis of the economic impact of water effluent guidelines upon various asphalt and tar using industries was performed based on water treatment cost data supplied by the EPA. The asphalt using industries included paving, roofing and flooring. A methodology was developed to systematically judge the broader economic effects on these materials, resulting from the application of water effluent control, first by assessing the likelihood that treatment costs would be defrayed through price increases, and secondly, if price increases were not likely, the extent to which profits would be impacted and/or the likelihood that plant shutdowns would occur. Based on this approach and using the treatment costs supplied, it was concluded that a limited number of plant shutdowns would occur in the asphalt paving sector if best practicable technology standards were imposed on that industry.

17. Key Words and Document Analysis. 17a. Descriptors

Economic Analysis
Effluent Guidelines
Development Document
Asphalt Concrete
Asphalt Emulsions
Asphalt Paving Industry
Asphalt Roofing Industry
Asphalt Flooring Industry

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

PRICES SUBJECT TO CHANGE

| 18. Availability Statement | 19. Security Class (This Report) | 21. No. of Pages |
|---|---|---|
| This document will be available through the National Technical Information Service Springfield, Virginia 22151 | UNCLASSIFIED | 87 |
| | 20. Security Class (This Page) UNCLASSIFIED | 22. Price $5.00 - 2.25 |

# ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE PAVING AND ROOFING MATERIALS (Tars and Asphalt) INDUSTRY

Arthur D. Little, Incorporated

Prepared For

ENVIRONMENTAL PROTECTION AGENCY

NOVEMBER 1975

# PREFACE

The attached document is a contractor's study prepared with the supervision and review of the Office of Planning and Evaluation of the U.S. Environmental Protection Agency (EPA). Its purpose is to provide a basis for evaluating the potential economic impact of effluent limitations guidelines and standards of performance established by EPA pursuant to sections 304(b) and 306 of the Federal Water Pollution Control Act.

The study supplements an EPA technical "Development Document" issued in conjunction with the promulgation of guidelines and standards for point sources within this industry category. The Development Document surveys existing and potential waste treatment and control methods and technologies within this category and presents the investment and operating costs associated with various control technologies. This study supplements that analysis by estimating the broader economic effects (including product price increases, continued viability of affected plants, employment, industry growth and foreign trade) of the required application of certain of these control technologies.

The study was submitted in fulfillment of contract No. 68-01-1541, task number 28, by Arthur D. Little, Inc. Work was completed in September 1974 and the report was published entitled "Economic Analysis of Proposed Effluent Guidelines - Paving and Roofing Materials (Tars and Asphalt)." The report was circulated in conjunction with the publication in the Federal Register of a notice of proposed rulemaking under sections 304(b) and 306 for the point source category. This publication includes only a few minor editorial revisions to the original study; no substantive changes were made in the regulations or the associated costs of compliance upon promulgation of final guidelines.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulation, and other materials in the establishment of final effluent limitations guidelines and standards of performance.

## TABLE OF CONTENTS


| | Page |
|---|---|
| List of Tables | vii |
| List of Figures | ix |
| EXECUTIVE SUMMARY | 1 |
| BACKGROUND AND OBJECTIVES | 1 |
| CONCLUSIONS | 1 |
| PAVING MIXTURES AND BLOCKS (SIC 2951) | 2 |
| 1. Asphalt Concrete | 2 |
| 2. Asphalt Emulsions | 4 |
| ASPHALT FELTS AND COATINGS (SIC 2952) | 5 |
| ASPHALT BASED FLOORING PRODUCTS (SIC 3996) | 7 |
| METHODOLOGY | 9 |
| PART I: ASPHALT PAVING MIXTURES AND BLOCKS (SIC 2951) | 11 |
| A. INDUSTRY STRUCTURE | 11 |
| 1. Products and Demand | 11 |
| 2. Manufacturing and Ownership Profile | 21 |
| 3. Financial Profile | 30 |
| 4. Prices and Price Setting | 34 |
| B. PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS | 41 |
| C. ECONOMIC IMPACT ANALYSIS | 45 |
| 1. Price Effects | 45 |
| 2. Financial Effects | 48 |
| 3. Production Effects | 49 |
| 4. Employment Effects | 49 |
| 5. Community Effects | 49 |
| 6. Balance of Trade Effects | 49 |




Preceding page blank

TABLE OF CONTENTS (Continued)


| | | Page |
|---|---|---|
| **PART II: ASPHALT FELTS AND COATINGS (SIC 2952)** | | 51 |
| A. | INDUSTRY STRUCTURE | 51 |
| | 1. Products and Demand | 51 |
| | 2. Manufacturing and Ownership Profile | 56 |
| | 3. Financial Profile | 64 |
| | 4. Prices and Price Setting | 66 |
| B. | PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS | 67 |
| C. | ECONOMIC IMPACT ANALYSIS | 68 |
| | 1. Price Effects | 68 |
| | 2. Financial Effects | 70 |
| | 3. Production Effects | 72 |
| | 4. Employment Effects | 72 |
| | 5. Community Effects | 72 |
| | 6. Balance of Trade Effects | 72 |
| **PART III: ASPHALT-FELT BASE FLOOR COVERINGS (SIC 3996)** | | 73 |
| A. | INDUSTRY STRUCTURE | 73 |
| | 1. Products and Demand | 73 |
| | 2. Manufacturing Profile | 75 |
| | 3. Prices and Price Setting | 77 |
| B. | PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS | 77 |
| C. | ECONOMIC IMPACT ANALYSIS | 78 |
| **LIMITS OF THE ANALYSES** | | 79 |

## LIST OF TABLES


| Table No. | | Page |
|---|---|---|
| I-1 | Shipments of Petroleum Asphalt for Paving by Product | 12 |
| I-2 | Sales of Petroleum-Asphalt Paving Products for Consumption in the United States by P.A.D. Districts and States | 13 |
| I-3 | Shipments of Asphalt Concrete | 14 |
| I-4 | Asphalt Paving Materials -- Value of Shipments | 15 |
| I-5 | Value of Shipments of Asphalt Paving Mixtures and Emulsions (SIC 2951) | 16 |
| I-6 | Estimated Cost of Construction Materials and Supplies Used for Interstate and Federally-Aided Primary Highways, and All Public Highways for Selected Years | 17 |
| I-7 | Distribution of 1972 Production | 20 |
| I-8 | Integration of Company Operations | 22 |
| I-9 | End Uses of Emulsified Asphalts | 22 |
| I-10 | Number of Hot Mix Asphalt Plants by Size of Mixer | 23 |
| I-11 | Existing Asphalt Hot Mix Plants in the United States by Region (January 1974) | 24 |
| I-12 | General Statistics by Geographic Area (1967) | 26 |
| I-13 | SIC 2951 General Statistics, by Employment Size of Establishment (1967) | 27 |
| I-14 | Concentration Ratios: Percent of Total Business (SIC 2951) | 28 |
| I-15 | Hot-Mix Asphalt Production of Reporting Companies Grouped by Volume of Production | 29 |
| I-16 | SIC 2951 Selected Statistics for Operating Manufacturing Establishments, by Type of Operation and Legal Form of Organization for Major Industry Groups and Industries | 31 |
| I-17 | Selected Statistics SIC 2951 (1963-1971) | 32 |
| I-18 | Selected Operating Ratios SIC 2951 (1963-1971) | 33 |
| I-19 | Financial Profile – SIC 2951 | 34 |
| I-20 | Average Operating Statement for Asphalt Hot Mix Plants (1972) | 36 |
| I-21 | Average Operating Statement for Asphalt Emulsion Plants (1972) | 37 |
| I-22 | Average Bid Price Trends on Federal Aid Highway Contracts | 37 |
| I-23 | Asphalt Concrete Prices | 39 |
| I-24 | Materials Consumed by the Asphalt Paving Industry (1967) | 39 |
| I-25 | Relative Average Prices (Asphalt Concrete) | 40 |
| I-26 | Relative Average Prices (Emulsions) | 41 |

LIST OF TABLES (Continued)


| Table No. | | Page |
|---|---|---|
| I-27 | Effluent Limitations for Asphalt Emulsion Plants | 42 |
| I-28 | Effluent Limitations for Asphalt Concrete Plants | 42 |
| I-29 | Treatment Costs for Asphalt Emulsion Plants | 44 |
| I-30 | Treatment Costs for Asphalt Concrete Plants | 44 |
| II-1 | Total Shipments of Asphalt Felts & Coatings: 1963-1972 | 53 |
| II-2 | Shipments of Asphalt Felts and Coatings by Product Type, 1967-1972 | 54 |
| II-3 | Shipments of Asphalt and Tar Roofing and Siding Products, 1972 | 54 |
| II-4 | SIC 2952 -- Industry Operating Profile | 57 |
| II-5 | General Statistics, by Geographic Areas: 1967 | 60 |
| II-6 | General Statistics, by Geographic Areas: 1972 | 61 |
| II-7 | Materials Consumed in the Manufacture of Asphalt Felts and Coatings, 1967 | 62 |
| II-8 | Materials Consumed in the Manufacture of Asphalt Felts and Coatings, 1972 | 62 |
| II-9 | Selected Statistics for Operating Manufacturing Establishments, by Type of Operation and Legal Form of Organization for Major Industry Groups and Industries: 1967 | 63 |
| II-10 | Income Statement -- Typical Plant, 1973 | 65 |
| II-11 | Wholesale Price Index for Prepared Asphalt Roofing | 66 |
| II-12 | Effluent Limitations for Asphalt Roofing Plants | 67 |
| II-13 | Treatment Costs -- Asphalt Roofing Plants (Small) | 69 |
| II-14 | Treatment Costs -- Asphalt Roofing Plants (Typical) | 70 |
| II-15 | Treatment Costs -- Asphalt Roofing Plants (Large) | 71 |
| III-1 | Value of Shipments of Hard Surface Floor Coverings | 74 |
| III-2 | SIC 3996 -- Industry Operating Profile | 76 |
| III-3 | Effluent Limitations for Linoleum and Asphalt Printed Felt Plants | 77 |
| III-4 | Treatment Costs -- Linoleum and Asphalt Felt Plants | 78 |

## LIST OF FIGURES


| Figure No. | | Page |
|---|---|---|
| I-1 | Estimated Cost of Construction Materials and Supplies Used for Interstate and Federally-Aided Primary Highways, and All Public Highways for Selected Years | 18 |
| I-2 | Selected Statistics SIC 2951 (1963-1971) | 35 |
| II-1 | SIC 2952 – Industry Operating Profile | 58 |

## EXECUTIVE SUMMARY

### BACKGROUND AND OBJECTIVES

The purpose of this report is to present an analysis of the potential economic impact on the asphalt roofing and paving industries of pollution abatement requirements under the Federal Water Pollution Control Amendments of 1972 for each of three levels of effluent treatment:

- Proposed best practicable control technology currently available (BPT).
- Proposed best available technology economically achievable (BAT).
- Proposed new source performance standards (NSPS).

The segments of the asphalt paving and roofing materials industries are contained within:

- SIC 2951 – paving mixtures and blocks
- SIC 2952 – asphalt felts and coatings
- SIC 3996 – asphalt-felt-base floor coverings

Mobile and stationary asphalt paving plants operated by highway contractors (SIC 1611) are also discussed with SIC 2951.

The report is presented in two principal parts for each SIC category. The first part is a characterization of the industrial category based on the U.S. Bureau of the Census statistics, on trade association and other industry data, and on other primary and secondary sources investigated by the contractor. The second part analyzes the probable economic impact on the industries arising from the promulgation of the effluent treatment Guidelines.[1]

### CONCLUSIONS

The proposed effluent Guidelines will not have a significant impact on the economic performance of the asphalt paving, roofing and flooring industries.

Of the 4750 plants operating in the asphalt concrete sector of the paving industry, approximately 500 (10.5%) must meet Guidelines. Of these latter, 10-15 plants will probably choose to close as a direct result of the Guidelines. The remainder of the 500 plants will pass on the incremental costs of pollution control, representing a maximum price

---

1. As detailed in *Development Document for Proposed Effluent Limitations Guidelines and New Source Performance Standards for Paving & Roofing Materials (Tars and Asphalt).* The report was prepared by the National Field Investigations Center – Cincinnati, U.S. Environmental Protection Agency, August, 1974.

increase of about 1%. Closure of the 10-15 plants will affect about 50 employees in urban areas where alternative employment opportunities exist.

Full cost pass through, with no other economic impact, is anticipated in the asphalt emulsion sector of the paving industry and in the asphalt roofing industry. Price increases to meet BAT requirements will be a maximum of 1.2¢ per ton on a 1973 average selling price of $63.45 per ton for asphalt emulsions, and 46¢ per ton (0.58%) for asphalt roofing.

Baseline closures are anticipated in the asphalt-based flooring products sector so the industry will probably not be in existence by 1977.

More specific conclusions are summarized in the following paragraphs.

## PAVING MIXTURES AND BLOCKS (SIC 2951)

Approximately 4,800 plants in the United States produce asphalt-based paving mixtures. The great majority of these plants (4,750) produce asphalt concrete, while the remainder produce asphalt emulsions.

### 1. Asphalt Concrete

#### Industry Characterization

The asphalt concrete segment has grown steadily over the past few decades, reflecting largely the increased levels of federal, state, and local funding for the expansion of roadways in the United States. In 1973, this segment of the industry reached a record level of production of 358 million short tons, but a 16% decline is anticipated in 1974. It is unlikely that the 1973 level of production will be equalled before 1980, primarily because of a decline in new road construction as the Federal Interstate and Defense highway system is completed and as Trust Fund monies are diverted to other forms of transit. Although maintenance expenditures will allow modest growth at 2% per year from 1974 to 1980, it is likely that up to 500 marginal asphalt paving plants will be forced to close over this period as the industry continues its trend toward greater concentration.

Plants in this segment of the industry may range in capacity from 50 to 500 short tons per hour. The average sized existing plant has a capacity of approximately 150 tons per hour, while the average new plant is closer to 300 tons per hour. Asphalt plants operate intermittently, producing only for specific demand.

The substantial costs (13¢/ton/mile) of shipping asphalt from the plant to the job site mitigate against interregional or international shipments of the product. There is some regional differentiation in regard to the length of the production year. (Plants in the South

are able to operate year round, while northern plants are forced to close in the winter months.) U.S. production averages 35-40% of rated capacity.

Of the 4,750 plants in the asphalt concrete segment, 25%, or 1,200, are estimated to be "mobile" plants, which serve temporary market areas, and are moved to other sites upon the completion of specific projects. While the remainder, or "fixed" plants may be dismantled and moved, it is a costly process; so such moves are undertaken only when the market area that the plant was set up to serve has deteriorated significantly.

The pattern of ownership of plants in this industry ranges from one-plant, privately-owned operations, to firms which own in excess of 100 plants throughout the country, and operate as subsidiaries of major corporations, often in the oil industry. Over the past decade these larger firms have increased their market share, often by acquiring the assets of smaller companies. Despite this trend, however, the industry is characterized by a low level of concentration.

The median profitability of asphalt concrete plants is 4% on sales, and 10% on owners' equity, slightly below the national average of 10.6% for all manufacturing concerns. Plants in the industry range from marginally profitable installations, to some which have returns on owners' equity approaching 25%. Recently margins have been adversely affected by the rapid increases in the cost of asphalt cement, which comprises a major proportion of the cost of asphalt concrete. Asphalt concrete is sold largely on a bid basis for specific projects. Because the larger of these projects may run longer than a year, increases in cost of production over the period of the contract may not be recovered.

Competition within the industry and between the industry and Portland cement concrete may be severe but is generally mitigated by economic factors. Over the years, asphalt concrete has maintained a first-cost advantage vis-a-vis Portland cement concrete, although average annual costs of maintenance and resurfacing are higher. Within the industry the high costs of shipping the product tend to limit encroachments of market area by competing plants.

Effluent Limitations, Technologies and Costs

For the asphalt concrete sector BPT and BAT requirements are considered to be equivalent; both are due to be achieved by 1977. Each calls for the installation of an earthen settling basin for effluents resulting from wet process particulate control process equipment, and for the recycling of the water which has been settled. The costs for the installation of this technology range from $4,600 for a small plant (1,000-ton-per-day capacity) to $6,400 for a large plant (2,500-ton-per-day capacity). Annual costs, including operating expenses, energy, and amortization of capital, range from 11.3¢ per ton for the small plants to 8.1¢ per ton for the larger plants. This compares to an average 1973 selling price for the product of $8.00 per ton.

Economic Impact

The proposed effluent Guidelines will not have a significant economic impact on the industry. Of the 4,750 asphalt concrete plants, approximately 1,200 are equipped with dry process particulate control equipment and are therefore not subject to the Guidelines; of the remaining plants, about 3,100 are already in compliance. The approximately 500 plants that must meet the Guidelines (10.5%) are located primarily in rural areas, without significant inter-, or intra-industry competition. The effects of high transportation costs historically have enabled asphalt concrete plants to increase prices without prejudice to their market position. Most will, therefore, pass on the incremental costs of pollution control, representing a maximum price increase of 1%.

Baseline closures are anticipated in about 500 cases before 1980 and it is possible that a very small proportion (estimated at 10-15) of these 500 plants affected will choose to close by 1977 as a direct result of the Guidelines. It is estimated that 50 employees will be affected by their closure. Because these plants will be located in urban areas where alternative employment opportunities exist, community effects will be negligible. Because the industry operates currently at 35-40% of capacity, these closures will have no measurable effect on production levels. As a result of high transportation costs, international trade in asphalt concrete does not exist, and therefore, there will be no balance of payments effects.

## 2. Asphalt Emulsions

Industry Characterization

The level of production of asphalt emulsions for paving purposes has remained steady over the last decade. While some emulsions are used for roofing and for industrial uses, paving is by far the predominant use.

Although production in 1974 is expected to drop 15-20% from the levels achieved in 1973, the outlook for this segment is favorable through 1980. A 4%/yr rate of growth from 1974 to 1980 is anticipated, primarily because of the attractiveness of emulsions as a substitute for asphalt cutbacks, which are expected to be phased out for reasons of energy conservation, and the growing need for emulsions as a road base stabilizing ingredient.

Emulsion plants are distributed nationally, but a large proportion are located in the Midwest, where the quality of the naturally occurring aggregates for road base often requires the use of emulsions as a stabilizing agent, and where the markets for the industrial uses of the product are most concentrated.

Emulsion plants are believed to be slightly more profitable than concrete plants, although little published data exists to support this conclusion. They are a complementary, rather than a competing product to asphalt concrete, and, as a result, 15-20% of the companies in the asphalt concrete business also distribute or produce emulsions.

Effluent Limitations, Technologies and Costs

BPT requirements for the emulsions sector consist of dikes to control the runoff of process wastes which have settled around the plant site, and the removal of oil and grease through a separator. BAT calls for the construction of a sedimentation basin to supplement this system. The costs for the installation of such a system for an average sized plant (6,000 short tons per day) is $73,290 for BPT and $80,790 for BAT. The annual operating costs are 1.1¢ per ton for BPT and 1.2¢ per ton for BAT. This compares to an average 1973 selling price of $63.45 per ton.

Economic Impact

Given the proportion these incremental costs bear to the average selling price of asphalt emulsions it is concluded that the costs can easily be passed on by the industry. No major difficulty is expected in raising the capital for these processes. The economic impact will, therefore, be negligible.

## ASPHALT FELTS AND COATINGS (SIC 2952)

Industry Characterization

SIC 2952 includes a variety of products, all employing asphalt as one ingredient, used to waterproof the exterior of a building structure: asphalt saturated felts, roofing asphalts and pitches, strip shingles, and many others. The saturated felt products can be classified as either prepared roofings or built-up roofings. Both types are basically similar, each being made of a structural felt or fabric framework, a soft asphalt saturant for the felt, and a relatively hard coating on the surface of the felt.

Shipments of asphalt felts and coatings have shown steady and almost uninterrupted growth over the past decade, increasing from $459.5 million in 1963 to $877.1 million in 1972, an annual rate of better than 7%. The principal products shipped each year are asphalt and tar roofings and sidings, which represent 75% of all group shipments. These products are used throughout the United States in relation to the volume of new building construction and of existing stock. Imports and exports have been and remain at a very low level.

Roofing plants are located close to or in heavily populated areas and thus manufacturers' warehouses remote from the plants are seldom used for distribution. Manufacturers tend to specialize in prepared or in built-up roofing and brand identification is

prevalent in the former. Roofing has a relatively low value per unit weight; thus freight can make shipment uneconomic in competition with other plant locations.

It is estimated that 30% of all roofing products in this industry sector is used for non-residential building construction, with the remainder used for residential roofing. Reroofing of residential structures is an extremely important segment of the market, ranging from approximately 50% of all residential roofing in a good year for new residential construction, to 75% in an off-year. Reroofing also represents about 65% of all roofing sales to the non-residential building sector. The overall growth of the roofing industry will be close to 4%/year on a weighted basis to 1980. As the industry is now operating at or close to the maximum effective capacity, new plants or expansions of existing ones are a necessity.

The industry is comprised of approximately 233 manufacturing establishments, about 108 of which produce dry and saturated roofing felts whereas the remainder concentrate on asphalts, coatings and cements. Roofing plants in this industry range in size from 25,000 to 200,000 short tons per year, with the average at about 80,000 tons per year.

Manufacturing plants in this industry also vary significantly by net asset value. The oldest operating facility (built 80 years ago) has a net asset value considerably less than $1 million; newer facilities have assets as high as $6 million and the average book value for all 108 plants is about $2.2 million. A typical plant, with a daily capacity of 500 tons and net assets of about $2.5 million, will produce an average of 120,000 tons of roofing products each year. Such a plant will average a return of 5% or better on sales and 15-20% on net assets invested.

Of the 226 establishments operating in 1967, 153 were multi-unit companies and 192 were public corporations. The industry has traditionally been characterized as one of family-owned companies with regional concentrations, but a considerable number of acquisitions and mergers over the past decade has consolidated U.S. production. Despite these changes in industry structure, the concentration ratios have varied little over the past decade. Currently, the four largest companies share approximately 38% of industry shipments and the eight largest, 65%.

Manufacturers publish regional dealer price lists; basic list prices have been revised frequently over the past year as manufacturers have attempted to maintain margins in the face of considerable price increases for basic raw materials, especially asphalt. As a result, average prices could increase as much as 15% during 1974.

Effluent Limitations, Technologies and Costs

The Development Document has proposed effluent limitations for a typical plant using 150,000 gallons of process water per day and producing 500 short tons of product per day. Investment and operating, maintenance and energy costs have been estimated for this level of production and also for smaller and larger facilities producing 200 short tons and 700

short tons per day, respectively. The majority of asphalt roofing plants are already removing part of the suspended solids from their waste water before discharging it; the proposed best practicable control technology currently available (BPT) requires that all plants employ primary settling for this purpose. The proposed best available technology economically achievable (BAT) further requires that coagulants be used to settle out more suspended solids. While it is assumed that either an earthen stilling basin or a steel or concrete settling tank will be used to achieve BPT, the settling tank is the more likely solution for BAT requirements to allow for continuous sludge removal.

Investment costs for BPT will range from $3,500 to $30,000 depending on the size of plant and treatment technology used. For BAT they will range from $37,000 to $67,500. Incremental costs per short ton will range from 2¢ to 10¢ for BPT and from 14¢ to 32¢ for BAT.

Economic Impact

Assuming an average base selling price of $80 per short ton of shipments, the maximum price increases required to pass through the cost of meeting BPT guidelines and, at the same time, maintain current returns on net assets, would be 0.23% for a small plant. To meet BAT and NSPS treatment requirements, the equivalent selling price increases would be a maximum of 0.58%. As the industry is currently enjoying favorable returns on current net assets and a steady increase in market growth, costs will be passed through fully in the form of price increases. The current capacity shortage situation, partly contributing to significant price increases, reinforces this conclusion.

Consequently, no profitability effects are anticipated and it is further concluded that the availability of capital to meet the effluent control requirements will also present no problems. The total cumulative investment required by the average sized roofing plant by 1983 is $55,000, equivalent to about 2.5% of the average net asset value of all plants; this figure compares to the annual average capital expenditures by the industry of $135,000 per plant over the past five years.

In addition, no production, employment, community or balance of trade effects are anticipated from the implementation of the proposed effluent Guidelines.

## ASPHALT BASED FLOORING PRODUCTS (SIC 3996)

The economic impact analysis of this industry sector is concerned solely with plants engaged in the production of linoleum and asphalt printed felt floor coverings. Research indicates that only one manufacturing facility presently produces asphalt-based linoleum floorings and this plant is gradually being phased out of production and converted to vinyl flooring production. A similar reduction in production is apparent for asphalt printed felts, with only two companies still in production. Shipments of asphalt felt base and linoleum floor coverings have declined from $30.8 million in 1967 to $15.1 million in 1972.

The market for asphalt-based flooring products derives from a very limited demand for an extremely low cost product that has a relatively short life expectancy. This demand is expected to become non-existent within about three years as consumer preference for vinyl and vinyl asbestos flooring increases. Lower costs resulting from economies of scale and technical innovations for competing products will help to eliminate demand for asphalt-based floorings. Furthermore, the price of refined asphalt feedstock has increased considerably recently and the feedstock is in short supply, thus increasing the relative cost of asphalt flooring. Consequently, asphalt's single market advantage, low cost, is rapidly disappearing and with it the only justification for continued significant production of the product. Thus baseline closures are anticipated so the industry will probably not be in existence by 1977.

## METHODOLOGY

The methodology used to determine the economic impact of effluent treatment guidelines[1] on operating plants in each sector included a comparison of the estimated capital and total yearly costs of controls with the estimated profitability and average product prices for typically sized plants in each sector. Short tons is the unit of weight employed throughout this analysis because this reflects the economic measure used by the industries under consideration.

For the purposes of this analysis, the annuity method of calculating total yearly costs has been used. Operating, maintenance, energy and capital costs were amortized at a 15% discount rate over 10 years. While this approach differs from that used in the Development Document it more accurately reflects typical corporate policies and, at the same time, results in similar total yearly costs to those in the Development Document.

Potential price effects were measured by assessing the average price increases that would be required to absorb fully the incremental annual operating costs for pollution controls, assuming that the same level of profits by operating units were maintained. In the case of asphalt roofing and asphalt concrete plants, three sizes of operating units were assumed for each sector in order to assess the potential economies of scale that might result. Price increases might range from full pass-through of incremental costs to full absorption, depending on the specific technology already in effect, the market and competitive environment and the current levels of profitability for individual facilities. Judgment was used in estimating the number of facilities that would be able to pass costs on fully, or have to absorb them partially or completely.

Depending on the degree to which costs pass-through can be achieved, further economic effects can result on operating units in each sector. The primary economic effect could be a reduction in, or elimination of operating profitability if prices could not be increased. The analysis examines this effect for the full spectrum of price increases and also assesses the availability of capital required to implement the control technologies. Finally, in the cases where cost absorption results in a severely reduced level of operating profitability, the possibility of plant shutdowns, resulting production, employment, community and balance of trade effects is examined judgmentally to obtain an appreciation of the full economic impact that could result from implementing the effluent guidelines.

---

1. As detailed in *Development Document for Proposed Effluent Limitations Guidelines and New Source Performance Standards for Paving & Roofing Materials (Tars and Asphalt)*. The report was prepared by the National Field Investigations Center – Cincinnati, U.S. Environmental Protection Agency, August, 1974.

# PART I: ASPHALT PAVING MIXTURES AND BLOCKS (SIC 2951)

## A. INDUSTRY STRUCTURE

### 1. Products and Demand

#### a. Products

The asphalt paving industry in the United States has developed from the need to construct and maintain durable roadways for the use of automotive traffic. Dependent in its early life on the limited supply of naturally occurring asphalt deposits, the industry grew dramatically with the discovery of petroleum derivative asphalt. In recent years, growth has continued at a steady rate, reflecting the continued federal and state sponsorship of major highway construction.

The asphalt paving industry is included both in Standard Industrial Classification (SIC) 2951, Paving Mixtures and Blocks, and in SIC 1611, Highway Construction. Those plants included in the former classification derive the major portion of their revenues from the sale of paving mixtures to third parties. Those in the latter classification derive the major portion of their revenues from the application of their asphalt products by their own construction crews. Our analysis of this SIC relates only to the mobile and stationary asphalt plants operated by highway contractors. SIC 2951 also includes such products as asphalt paving blocks, creosoted wood paving blocks, composition paving blocks, mastic floor compositions, and coal tar paving materials. These products are relatively insignificant in sales and declining in use. Effluent guidelines were not defined for these miscellaneous categories, so this analysis will not consider them in any further detail.

The two main products within the asphalt paving industry are asphalt emulsions and asphalt concrete. Emulsions are a combination of asphalt cement and water whose natural immiscibility has been mitigated by an emulsifying agent. Their primary use in paving is in the repair and maintenance of existing roadways. Asphalt emulsions are also used in very small amounts in the roofing sector. Asphalt concrete* is a heated and compacted mixture of asphalt cement and well-graded aggregates. Its primary uses are the construction of roads and highways, airport runways, driveways, and parking lots. It has a variety of other uses including tennis courts, swimming pools, playgrounds, feedlots, and industrial floors. Cutbacks, asphalt cement liquefied by the addition of higher distillates, are also used for paving but they are produced primarily at petroleum refineries, and not by asphalt paving producers, although they may be marketed and distributed by the latter. Since these industries are not involved in the manufacturing processes, these products have been eliminated from consideration in this analysis.

*often referred to as "hot-mix" asphalt



Preceding page blank

b. Manufacturing Processes

The manufacturing processes are discussed in detail in the Development Document. Approximately 8% of the plants that produce asphalt concrete utilize continuous mixing processes rather than the batch process described in the document. There are no significant process differences among emulsion plants.

c. Production and Shipments

Production figures for the asphalt paving industry may be most closely derived from data compiled by the Department of the Interior, Bureau of Mines, on shipments of petroleum asphalt to the asphalt paving industry. Shipments have increased from 16.9 million short tons in 1963 to 24.1 million short tons in 1972. This increase has been steady, with a slight drop shown only in one year (1967). Shipments in 1972 were at an all time peak. Table I-1 lists these shipments in total from 1963, and by product from 1968. Shipments of cement, used for the production of asphalt concrete, have increased at a more substantial rate, while shipments of emulsions and cutbacks have remained relatively constant over the last six years. Table I-2 lists the regional breakdown of these shipments for 1971 and 1972.

**TABLE I-1**

**SHIPMENTS OF PETROLEUM ASPHALT FOR PAVING BY PRODUCT**
**(Millions of Short Tons)**

| Year | Asphalt Cement | Emulsions | Cutbacks | Total* |
|---|---|---|---|---|
| 1963 | N/A | N/A | N/A | 16.9 |
| 1964 | N/A | N/A | N/A | 17.4 |
| 1965 | N/A | N/A | N/A | 18.3 |
| 1966 | N/A | N/A | N/A | 19.6 |
| 1967 | 12.7 | N/A | N/A | 18.9 |
| 1968 | 14.2 | 2.2 | 4.3 | 20.7 |
| 1969 | 15.2 | 2.1 | 4.1 | 21.3 |
| 1970 | 17.2 | 2.3 | 4.1 | 23.6 |
| 1971 | 17.6 | 2.3 | 3.9 | 23.8 |
| 1972 | 18.1 | 2.2 | 3.9 | 24.1 |

*Totals may not add due to rounding.

N/A – Not Available

**Source:** *Mineral Industry Surveys*, U.S. Dept. of the Interior, Bureau of Mines 1963-1972.

## TABLE I-2

## SALES OF PETROLEUM–ASPHALT PAVING PRODUCTS FOR CONSUMPTION IN THE UNITED STATES BY P.A.D. DISTRICTS AND STATES

| District and State | Asphalt Cements | | Cutback Asphalts | | Emulsified Asphalts | | Total | |
|---|---|---|---|---|---|---|---|---|
| | 1970 | 1971[r] | 1970 | 1971 | 1970 | 1971[r] | 1970 | 1971 |
| District I: | | | | | | | | |
| Connecticut | | | | | | | | |
| Delaware | | | | | | | | |
| Florida | | | | | | | | |
| Georgia | | | | | | | | |
| Maine | | | | | | | | |
| Maryland & District of Columbia | | | | | | | | |
| Massachusetts | | | | | | | | |
| New Hampshire | | | | | | | | |
| New Jersey | | | | | | | | |
| New York | | | | | | | | |
| North Carolina | | | | | | | | |
| Pennsylvania | | | | | | | | |
| Rhode Island | | | | | | | | |
| South Carolina | | | | | | | | |
| Vermont | | | | | | | | |
| Virginia | | | | | | | | |
| West Virginia | | | | | | | | |
| District I, total | | | | | | | | |
| District II: | | | | | | | | |
| Illinois | | | | | | | | |
| Indiana | | | | | | | | |
| Iowa | | | | | | | | |
| Kansas | | | | | | | | |
| Kentucky | | | | | | | | |
| Michigan | | | | | | | | |
| Minnesota | | | | | | | | |
| Missouri | | | | | | | | |
| Nebraska | | | | | | | | |
| North Dakota | | | | | | | | |
| Ohio | | | | | | | | |
| Oklahoma | | | | | | | | |
| South Dakota | | | | | | | | |
| Tennessee | | | | | | | | |
| Wisconsin | | | | | | | | |
| District II, total | | | | | | | | |
| District III: | | | | | | | | |
| Alabama | | | | | | | | |
| Arkansas | | | | | | | | |
| Louisiana | | | | | | | | |
| Mississippi | | | | | | | | |
| New Mexico | | | | | | | | |
| Texas | | | | | | | | |
| District III, total | | | | | | | | |
| District IV: | | | | | | | | |
| Colorado | | | | | | | | |
| Idaho | | | | | | | | |
| Montana | | | | | | | | |
| Utah | | | | | | | | |
| Wyoming | | | | | | | | |
| District IV, total | | | | | | | | |
| District V: | | | | | | | | |
| Alaska | | | | | | | | |
| Arizona | | | | | | | | |
| California | | | | | | | | |
| Hawaii | | | | | | | | |
| Nevada | | | | | | | | |
| Oregon | | | | | | | | |
| Washington | | | | | | | | |
| District V, total | | | | | | | | |
| United States, total | 18,041,307 | 17,511,166 | | | | | | |

**Source:** Mineral Industry Surveys, U.S. Dept. of the Interior, Bureau of Mines.

The total production of asphalt concrete may be estimated by multiplying the shipments of asphalt cement by 18. (Asphalt cement constitutes approximately 1/18 of the weight of asphalt concrete.) Table I-3 lists this derived production from 1967. Emulsions and cutbacks used for paving purposes are not further processed within the asphalt concrete segment and the figures in Table I-1 accurately reflect their total production.

**TABLE I-3**

**SHIPMENTS OF ASPHALT CONCRETE**
**(Millions of Short Tons)**

| Year | Production |
|---|---|
| 1967 | 228.6 |
| 1968 | 255.6 |
| 1969 | 273.6 |
| 1970 | 309.6 |
| 1971 | 316.8 |
| 1972 | 325.8 |

**Source:** Contractor Estimates, based on 18 tons of asphalt concrete produced per ton of asphalt cement used for this purpose.

The value of shipments has risen at a somewhat greater rate than the volume of production, from $1,350 million in 1968 to $2,038 million in 1972. Table I-4 lists the value of shipments for plants in SIC 2951 from 1963, and an estimated value of total industry shipments from 1968. Table I-5 lists the value of shipments by product for SIC 2951 in 1972, 1967 and 1963. The unit price of asphalt concrete rose from $5.38 per ton in 1968 to $6.27 per ton in 1972 (17%). This increase was not as large as that registered by the general construction cost index which, as reported by Engineering News Record, rose by 26% over the same period. This is due, probably, to the relatively low labor content of the asphalt concrete manufacturing process.

Asphalt paving materials must be shipped in heated form directly to the job site. With trucking costs currently at 13¢ per mile, the effective shipping radius is very small, varying from 10 to 30 miles. As a result, no imports or exports are listed by the Department of Commerce for the industry. One may therefore assume that domestic consumption and shipments are equivalent.

d. Markets and Future Growth

The primary competition for asphalt paving materials is Portland cement concrete; in some rural areas there also may be competition from gravel and other natural road base materials. Table I-6 shows the relative use of asphaltic and concrete paving for new public

TABLE I-4

ASPHALT PAVING MATERIALS – VALUE OF SHIPMENTS
(Millions of Dollars)

| Year | SIC 2951 | + | Other* | = | Total Asphalt Concrete |
|---|---|---|---|---|---|
| 1963 | 402.9 | | N/A | | N/A |
| 1964 | 402.1 | | N/A | | N/A |
| 1965 | 423.6 | | N/A | | N/A |
| 1966 | 465.7 | | N/A | | N/A |
| 1967 | 529.6 | | N/A | | N/A |
| 1968 | 568.1 | | 781.9 | | 1,350.0 |
| 1969 | 609.8 | | N/A | | N/A |
| 1970 | 671.5 | | 1118.5 | | 1,790.0 |
| 1971 | 747.5 | | 1189.5 | | 1,937.0 |
| 1972 | 840.9 | | 1197.1 | | 2,038.0 |

*Expecially from SIC 1611

Sources: *Preliminary Census of Manufactures*, U.S. Bureau of the Census, 1972, *Hot Mix Asphalt, Plant & Production Facts*, National Asphalt Paving Association, 1970, 1971 1972.

highway construction in selected years from 1964 to 1972; Figure I-1 displays the data graphically. These figures indicate that while both markets have shown healthy growth over the last decade, asphalt has increased its market share at the expense of concrete. This growth may have been due to a number of factors, including: (1) market growth in geographical areas where frequent changes in temperature above and below 32° resulting in freeze-thaw damage, require the use of asphalt, and (2) the lower first-installed cost per mile of asphalt, which can be especially attractive in periods of inflationary pressures.

Approximately 15% of all producers of asphalt concrete also produce Portland cement concrete paving. In fact, the largest producer of asphalt, Warren Brothers Co., is also one of the two largest producers of Portland cement concrete used for highway construction.

Future demand for asphalt paving depends to a degree on the levels of new highway construction and, in turn, upon the levels of state and federal support for these programs. Two factors tend to forecast a longer-term decline in federal highway spending. First, the 42,500-mile National System of Interstate and Defense Highways is nearing completion. As of March 31, 1973, approximately 81% of this system had been completed, while another 16% was in either the construction or the planning stages. Second, the recent energy crisis can be expected to increase demands that portions of the Federal Highway Trust Fund be diverted to other transportation modes as specified in the Federal Aid Highways Act of 1973, primarily rapid transit systems. In fact, the City of Boston has recently applied for a diversion of $600 million of such funds for intercity rail improvements.

## TABLE I-5

## VALUE OF SHIPMENTS OF ASPHALT PAVING MIXTURES AND EMULSIONS (SIC 2951)

| Product | Total Shipments Including Interplant Transfers | | | | | |
|---|---|---|---|---|---|---|
| | 1972 | | 1967 | | 1963 | |
| | Quantity** | Value* | Quantity** | Value* | Quantity** | Value* |
| Paving Mixtures & Blocks (Total) | N/A | 840.9 | N/A | 529.6 | N/A | 402.8 |
| Paving Mixtures & Blocks: | | | | | | |
| Liquid Asphalt & Tar Paving Materials: | | | | | | |
| Emulsified Asphalt, Including Liquid Additives | 11.4 | 68.2 | 16.3 | 71.2 | 12.9 | 48.6 |
| Other Liquid Asphalt & Tar Paving Materials, Including Cutbacks | 8.1 | 49.1 | 5.7 | 22.9 | 7.7 | 33.5 |
| Asphalt & Tar Paving Mixtures & Blocks, Including Bituminous or Asphaltic Concrete, and Asphaltic Paving Cements | N/A | 590.2 | N/A | 365.8 | N/A | 294.2 |
| Other Paving Mixtures & Blocks, Except Brick, Concrete, or Stone | N/A | 11.2 | N/A | 9.4 | N/A | 8.8 |
| Paving Mixtures & Blocks, other | N/A | 122.2 | N/A | 60.3 | N/A | 17.7 |

*Millions of Dollars.

**Millions of Barrels

**Source:** U.S. Census of Manufactures 1967.

TABLE I-6

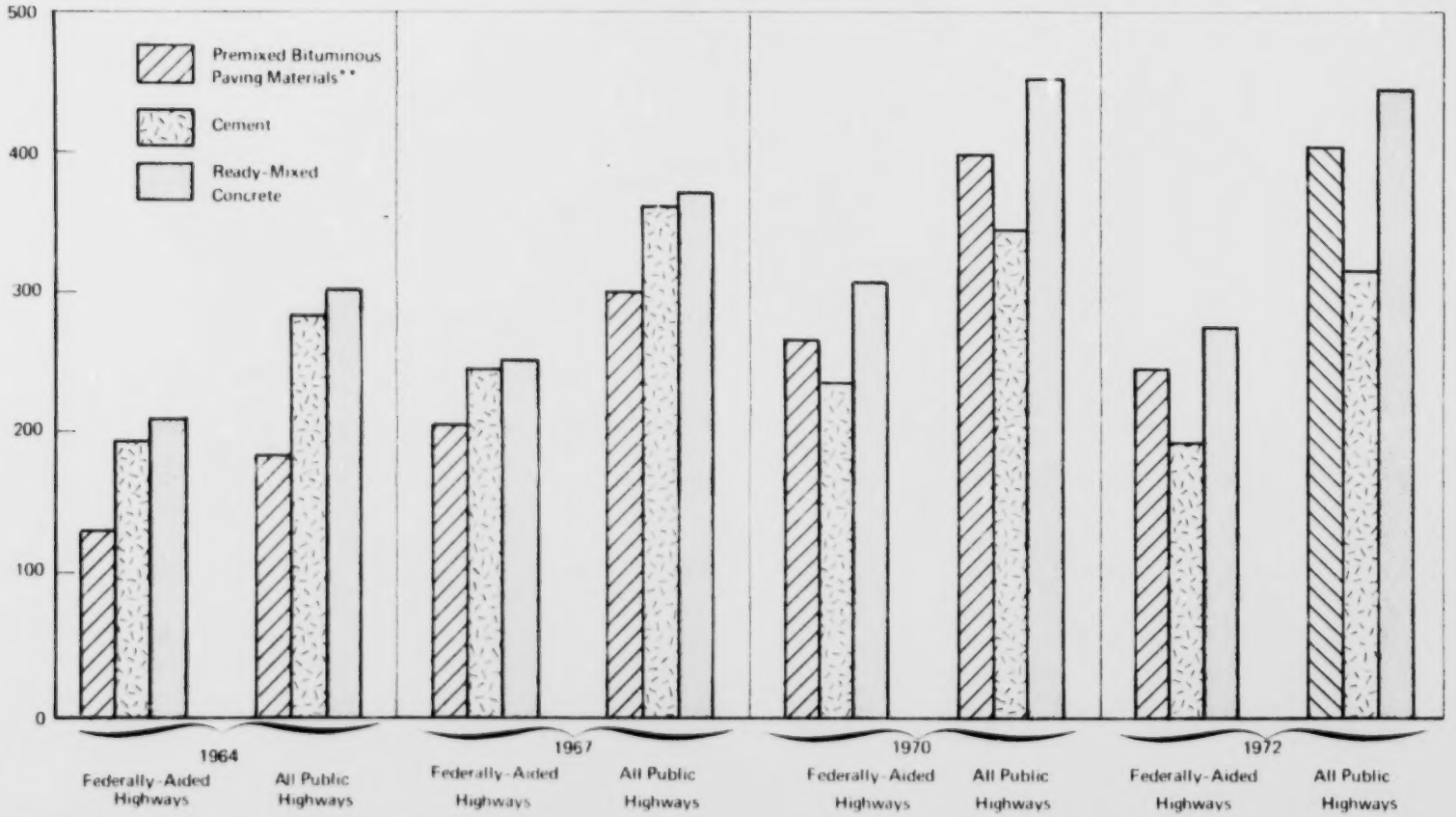
ESTIMATED COST OF CONSTRUCTION MATERIALS AND SUPPLIES USED FOR INTERSTATE AND FEDERALLY-AIDED PRIMARY HIGHWAYS, AND ALL PUBLIC HIGHWAYS* FOR SELECTED YEARS
(Millions of Dollars)

| Material | 1964 | | 1967 | | 1970 | | 1972 | |
|---|---|---|---|---|---|---|---|---|
| | Federally-Aided Highways | All Public Highways | Federally-Aided Highways | All Public Highways | Federally-Aided Highways | All Public Highways | Federally-Aided Highways | All Public Highways |
| Premixed Bituminous Paving Materials** | 131.6 | 188.2 | 205.2 | 301.2 | 268.3 | 395.4 | 249.3 | 402.9 |
| Cement | 199.7 | 285.5 | 246.3 | 361.5 | 237.1 | 349.4 | 194.6 | 314.4 |
| Ready-Mixed Concrete | 213.3 | 304.9 | 251.4 | 369.0 | 305.7 | 450.6 | 273.6 | 442.2 |

*Does not include maintenance and repair of highways nor construction of private roads, airport runways, etc.

**Asphalt Concrete

**Source:** U.S. Department of Commerce, *Construction Review*, August 1973




**Source**: U.S. Department of Commerce, *Construction Review*, August 1973.

*Does not include maintenance and repair of highways nor construction of private roads, airport runways, etc.

**Asphalt Concrete

**FIGURE I-1 ESTIMATED COST OF CONSTRUCTION MATERIALS AND SUPPLIES USED FOR INTERSTATE AND FEDERALLY-AIDED PRIMARY HIGHWAYS, AND ALL PUBLIC HIGHWAYS* FOR SELECTED YEARS**

Future demand many also be affected by the future price and supply of asphalt and competing materials. The price of asphalt paving materials has risen dramatically in the last few months, reflecting the skyrocketing price of asphalt cement, a petroleum derivative product. Availability has also been a problem, because refineries have concentrated their production on gasoline and fuel oil at the expense of liquid asphalt. However, the shortages of liquid asphalt have occurred during the winter when the majority of asphalt plants in the country are routinely shut down. Thus, the long-term effect of the energy crisis on both asphalt supply and demand is as yet uncertain.

A recent trend, which may mitigate the potential negative effects mentioned above, is the increasing use of full-depth asphalt pavements and deep-lift asphalt construction techniques. These procedures call for the substitution of asphalt for other base course materials, and have the effect of increasing the use of asphalt per mile of road constructed. It is also important to understand that in the asphalt paving industry, repaving and maintenance of existing roads has traditionally accounted for nearly 50% of the market. These markets constitute a steady outlet for the production of the industry, and are little affected by most of the factors mentioned above. Table I-7 shows the relative importance of the various markets for asphaltic concrete and the relationship between repaving and new construction for 1972.

Predictions as to future production are difficult because of the present uncertainty as to the availability and supply of asphalt cement. Also, the stabilizing of gasoline consumption and therefore, tax monies used for highway construction, because of unavailability and voluntary restraint, will inhibit future growth in demand for state and federal highway construction. As a result of these two factors, the industry is predicting a 16% decline in production of asphalt concrete in 1974 from the estimated record high level of production of 358 million tons in 1973. Because of the factors mentioned above, the production level achieved in 1973 is unlikely to be equalled through 1980. However, with the constant demand for resurfacing and maintenance and the continued strength in the private and commercial markets, the National Asphalt Paving Association (NAPA) projects that total demand will grow from the 300 million ton level of 1974 at a rate of 2% per year through 1980.

The demand for asphalt emulsions for paving purposes is currently very strong. The product is used increasingly as a stabilizing agent for the base courses of new highway construction. By applying a coat of asphalt emulsion to the base aggregates prior to laying the asphalt concrete above, road contractors are able to reduce the required depth of the base material. The emulsion also provides an effective water barrier between the road material and the base. These properties have increased the demand for emulsions in areas where the available supply of adequate base materials has been declining.

TABLE I-7

DISTRIBUTION OF 1972 PRODUCTION

| | Percent |
|---|---|
| **Type of Market:** | |
| Interstate Highways | 16 |
| State Highways (Excluding Interstate) | 30 |
| Municipal and County Roads | 21 |
| Airports | 3 |
| Private and Commercial | 28 |
| Other | 2 |
| | 100 |
| **End Use:** | |
| Surface and Binder | 67 |
| Hot Mix Base | 28 |
| Patching | 4 |
| Other | 1 |
| | 100 |
| **Type of Construction:** | |
| New Construction | 55 |
| Resurfacing and Maintenance | 45 |
| | 100 |

**Source:** *Hot Mix Asphalt, Plant & Production Facts, 1972,* National Asphalt Paving Association.

The recent energy crisis has also increased the demand for asphalt emulsions for paving. Emulsions are the primary alternative product for asphalt cutbacks. When cutbacks are applied to road surfaces, the higher distillates which have been used to liquefy the asphalt cement evaporate, leaving the cement as a binder. This method has been recognized recently by the industry and the government as a needless waste of the higher distillates. Consequently, cutbacks are being phased out rapidly, and emulsions can be expected to pick up the majority of their market share.

The asphalt concrete industry also is studying closely the feasibility of substituting emulsions for asphalt cement in their production process. The reasons for this are self-evident; the lesser amount of asphalt cement per volume in the emulsions would enable the asphalt concrete producers to reduce the effect of the price and availability problems they have been having with their raw materials.

Despite these demand factors, the industry has estimated a 15-20% decline in the production of emulsions in 1974 from the estimated 1973 level of 14 million barrels (2.6 million short tons). This decline is due, as with the hot-mix industry, to the lower

availability of raw materials (asphalt cement), and especially the expected decline in demand in 1974 for all paving products. However, shipments of emulsions are expected to grow over the next six years faster than asphalt concrete, at about 4% per year, because of the favorable demand factors mentioned above.

e. Marketing and Distribution

The maximum effective shipping radius for asphalt paving materials is approximately 30 miles. Much shorter distances are preferred to maximize the efficiency of the trucking fleet used to transport the mix from the plant to the job site. The potential market area for each stationary plant, therefore, is readily defined. Certain asphalt plants, called "mobile" or "nomad" plants, are designed with the capability of moving from market area to market area as conditions demand. This flexibility enables producers to supply remote temporary market areas, such as sites of new federal interstate highways, without having to depreciate their equipment over an artificially short time. Although it is rare, so-called "fixed" plants may also be moved if the equipment is in good shape, and the market area which they have been set up to serve has reduced in potential.

Asphalt paving materials generally are sold on a bid basis for specific projects. If the producer is also the contractor, he may have the flexibility to adjust his asphalt price in the bid in conjunction with the placing labor involved to reflect his bidding strategy. Contractors who are not producers must solicit bids from the producers in the area much as they do from other commodity suppliers. The advantage to the producer/contractor inherent in this situation explains the significant level of vertical integration within the paving industry as demonstrated in Table I-8. There is a trend, however, for producer/contractors to regard their plants as profit centers. This tends to mitigate the advantages mentioned above.

2. Manufacturing and Ownership Profile

a. Plant Characteristics

There are approximately 4,800 asphalt paving plants in the United States. Fifty of these produce asphalt emulsions. The remainder produce asphalt concrete. Of the 4,750 plants producing asphalt concrete, 872 are classified in SIC 2951. Virtually all plants in SIC 2951 are fixed. Plants in SIC 1611 may be fixed or mobile. Of the 4,750 asphalt concrete plants, an estimated 25%, or 1,200, are mobile plants.

The primary segmentation in the asphalt paving industry is between those plants which produce asphaltic concrete and those which produce asphalt emulsions. The differences between these two types of plants are discussed in depth in the Development Document.

Very little information is available on asphalt emulsion plants. The Bureau of Census data listed in Table I-5, and the Bureau of Mines data in Table I-1 are the extent of the data published on this segment by the government.

TABLE I-8

INTEGRATION OF COMPANY OPERATIONS

| | Number of Companies | |
|---|---|---|
| | 1972 | 1971 |
| Produces Hot Mix Asphalt | 382 | 336 |
| Places (Lays) Hot Mix Asphalt Produced by Another Company | 346 | 310 |
| Owns Gravel Pit or Quarry | 182 | 176 |
| Produces Portland Cement Concrete | 57 | 56 |
| Company is a Contractor For: | | |
| Road Construction | 316 | 302 |
| Other Types of Construction | 187 | 180 |
| Distributes Asphalt Emulsion | 64 | 52 |
| Distributes Liquid Asphalt | 71 | 55 |

**Source**: *Hot Mix Asphalt, Plant & Production Facts, 1972*, National Asphalt Paving Association.

Table I-5 showed the relative importance of emulsions within the industry. Emulsion plants are generally larger than asphalt concrete plants. In 1967, the average volume of emulsion plants was approximately $1.4 million per year. While these plants are dispersed nationally, they are heavily concentrated in the Midwest, where the quality of natural aggregates imposes a greater need for emulsions as road base sealers, and the markets for their miscellaneous uses (primarily industrial) are greatest. Table I-9 lists the relative importance of the end uses for the product.

TABLE I-9

END USES OF EMULSIFIED ASPHALTS
(Millions of Short Tons)

| Year | Paving | Roofing | Other | Total |
|---|---|---|---|---|
| 1968 | 2.184 | 0.007 | 0.078 | 2.269 |
| 1969 | 2.057 | 0.026 | 0.075 | 2.158 |
| 1970 | 2.341 | 0.014 | 0.286 | 2.641 |
| 1971 | 2.275 | 0.017 | 0.331 | 2.623 |
| 1972 | 2.179 | 0.014 | 0.343 | 2.536 |

**Source**: *Mineral Industry Surveys*, U.S. Dept. of the Interior, Bureau of Mines 1968-1972.

Table I-10 lists plant characteristics for 1,081 of the 4,750 plants from a survey by the National Asphalt Paving Association for 1971 and 1972. This table indicates that most plants use batch mixers, as opposed to continuous mixers. The great majority of all plants use mixers with a capacity of 4,000-7,999 pounds. Of these plants 144, or, 13%, have mixers of less than 4,000 pounds capacity, or under 960 tons per day, presuming 480 batches per day. There is an increasing use of automated plants. Mobile plants, as discussed above, constitute approximately 25% of all plants. There is no differentiation, in product, process, or treatment technology between mobile and fixed plants.

**TABLE I-10**

**NUMBER OF ASPHALT CONCRETE PLANTS BY SIZE OF MIXER**

| | | Number of Plants | |
|---|---|---|---|
| | **Mixer Size** | **1972** | **1971** |
| Stationary Plants | Under 4,000 lbs. | 119 | 133 |
| | 4,000 to 7,999 lbs. | 543 | 434 |
| | 8,000 to 9,999 lbs. | 81 | 74 |
| | 10,000 lbs. or more | 63 | 33 |
| | Continuous Mixer | 17 | 22 |
| Portable Plants | Under 4,000 lbs. | 25 | 40 |
| | 4,000 to 7,999 lbs. | 110 | 101 |
| | 8,000 to 9,999 lbs. | 27 | 33 |
| | 10,000 lbs. or more | 33 | 34 |
| | Continuous Mixer | 63 | 62 |
| Number of Automated Plants | | 608 | 441 |
| Number of Employees Per Plant | | 3.2 | 3.9 |

**Source:** *Hot Mix Asphalt, Plant and Production Facts, 1972,* National Asphalt Paving Association.

Asphalt concrete plants operate intermittently, rarely reaching their rated capacity for more than a short time. While the average capacity of the plants in this segment is estimated to be 1,600 short tons per day, the average production is closer to 600 short tons per day, although the ratio between capacity and production may vary significantly over time and between plants, depending on market conditions.

Because the asphalt paving industry is national in scope, and the product such that plants must be located very close to the markets, geographical segmentation of asphalt concrete plants is negligible. Table I-11 lists the location by state of the 4,002 asphalt paving plants identified by the National Asphalt Paving Association. Regional differences are determined solely by the levels of road and highway construction activity in each region. Rural regions tend to have a higher proportion of mobile plants than urban regions. There are price differences between regions, because of variations in the availability and cost of

TABLE I-11

EXISTING ASPHALT CONCRETE PLANTS IN THE UNITED STATES BY REGION (JANUARY 1974)

| Region I | | Region II | | Region III | | Region IV | |
|---|---|---|---|---|---|---|---|
| Conn. | 50 | D.C. | 4 | N.C. | 116 | Ala. | 82 |
| Maine | 28 | Del. | 8 | S.C. | 58 | Fla. | 115 |
| Mass. | 50 | Md. | 66 | Va. | 106 | Ga. | 83 |
| N. Hamp. | 20 | N.J. | 117 | | 280 | P.R. | 13 |
| R.I. | 12 | N.Y. | 212 | | | | 293 |
| Vt. | 12 | Pa. | 258 | | | | |
| | 172 | | 665 | | | | |

| Region V | | Region VI | | Region VII | | Region VIII | |
|---|---|---|---|---|---|---|---|
| Ind. | 130 | Ky. | 128 | Ark. | 38 | Ill. | 202 |
| Mich. | 147 | Tenn. | 105 | La. | 66 | Iowa | 68 |
| Ohio | 287 | W. Va. | 44 | Miss. | 91 | Mo. | 153 |
| | 564 | | 277 | | 195 | | 423 |

| Region IX | | Region X | | Region XI | | Region XII | |
|---|---|---|---|---|---|---|---|
| N. Mex. | 31 | Minn. | 114 | Colo. | 38 | Ariz. | 12 |
| Okla. | 57 | N. Dak. | 19 | Kansas | 61 | Calif. | 228 |
| Texas | 96 | S. Dak. | 31 | Nebr. | 37 | Hawaii | 10 |
| | 184 | Wisc. | 135 | Wyo. | 24 | Nev. | 8 |
| | | | 299 | | 160 | Utah | 18 |
| | | | | | | | 276 |

| Region XIII | |
|---|---|
| Alaska | 30 |
| Idaho | 27 |
| Mont. | 31 |
| Oreg. | 55 |
| Wash. | 71 |
| | 214 |

**Source:** Unpublished data, National Asphalt Paving Association.

asphalt cement; however, they are not important because the short required shipping radius makes interregional trade in the industry impossible. Table I-12 lists certain regional characteristics for the plants located in SIC 2951.

Of the 872 establishments included in SIC 2951 for 1967, only 64, or 7%, had more than 50 employees. The great majority of these larger establishments are believed to be asphalt emulsion facilities. Table I-13 describes the industry according to the number of employees per establishment. This table indicates an average of approximately 10 production workers per establishment. For the asphalt concrete paving industry (excluding emulsions), the National Asphalt Paving Association has estimated an average of 3.2 production workers per plant in 1972, a figure which has been steadily declining with the increased use of automated asphalt concrete plants.

These plants may be segmented for the purposes of this report by plant size and by the type of technology used to control particulate emissions. Those using dry processes are, of course, in compliance with the proposed EPA guidelines on effluent control. According to industry estimates, approximately 25% of existing plants are equipped with dry process control equipment, or "baghouses."

b. Firm Characteristics

There are approximately 1,350 firms in the asphalt paving industry. These firms range from small one-plant operations to large multi-plant firms serving regional markets. Two of the largest companies, Warren Brothers and Industrial Asphalt, are wholly-owned subsidiaries of major oil corporations -- Warren, of Ashland Oil and Refining, and Industrial, of Gulf Oil. Warren operates in excess of 100 plants. Companies in the 50-plant range, in addition to Industrial Asphalt, include Interstate Amiesite, Peter Kiewit and Sons, and General Crushed Stone. None of these companies, however, has nationwide coverage.

In general, the industry is characterized by a low relative degree of concentration. Concentration ratios of plants in SIC 2951 are shown in Table I-14. These ratios are among the lowest of all industries included in the Census of Manufactures. Ratios for the entire industry closely follow those for SIC 2951.

The National Asphalt Paving Association has compiled statistics within the paving industry about firm characteristics by size. These statistics, summarized on Table I-15, suggest that the larger firms (those having in excess of 200,000 tons of annual production) are growing at the expense of the smaller firms. Some of this growth has clearly been by the merger route, as the larger multiregional companies have been purchasing smaller companies to increase their market share within certain regions, but has also resulted from production and managerial efficiencies and a more sophisticated market approach.

TABLE I-12

GENERAL STATISTICS BY GEOGRAPHIC AREA (1967)
(SIC 2951)

| Geographic Area | Establishments Total | Establishments With 20 Employees or More | Total Number of Employees* | Total Number of Production Workers* | Value Added By Manufacture** | Value of Shipments** | Capital Expenditures, New** |
|---|---|---|---|---|---|---|---|
| United States | 872 | 155 | 12.2 | 8.5 | 234.7 | 584.6 | 23.8 |
| Northeast | 284 | 44 | 3.7 | 2.6 | 79.5 | 198.9 | 9.9 |
| North Central | 220 | 42 | 3.4 | 2.3 | 59.2 | 149.0 | 6.2 |
| South | 241 | 43 | 3.5 | 2.8 | 59.7 | 152.4 | 4.3 |
| West | 127 | 26 | 1.6 | 0.9 | 36.3 | 84.2 | 3.4 |

*Thousands

**Millions of Dollars

**Source:** *1967 Census of Manufactures;* U.S. Department of Commerce, Bureau of the Census.

TABLE I-13

SIC 2951 GENERAL STATISTICS, BY EMPLOYMENT SIZE OF ESTABLISHMENT (1967)

| | Number of Establishments | Total Number of Employees* | Total Number of Production Workers* | Value Added By Manufacture** | Value of Shipments** | Capital Expenditures, New** |
|---|---|---|---|---|---|---|
| Establishments (Total) | 872 | 12.2 | 8.5 | 234.7 | 584.6 | 23.8 |
| Establishments With An Average Of: | | | | | | |
| 1 to 4 Employees | 306 | 0.7 | 0.6 | 22.7 | 63.6 | 1.7 |
| 5 to 9 Employees | 255 | 1.7 | 1.2 | 42.4 | 130.9 | 5.5 |
| 10 to 19 Employees | 156 | 2.1 | 1.5 | 48.7 | 123.6 | 4.9 |
| 20 to 99 Employees | 142 | 5.5 | 3.7 | 94.1 | 207.3 | 10.1 |
| 100 to 499 Employees | 13 | 2.2 | 1.5 | 26.8 | 59.3 | 1.7 |

*Thousands.
**Millions of Dollars.

**Source:** *1967 Census of Manufactures*, U.S. Department of Commerce, Bureau of the Census.

**TABLE I-14**

**CONCENTRATION RATIOS: PERCENT OF TOTAL BUSINESS (SIC 2951)**

| Year | 4 Largest Firms | 8 Largest Firms | 20 Largest Firms | 50 Largest Firms |
|---|---|---|---|---|
| 1963 | 15 | 21 | 35 | 51 |
| 1966 | 15 | 23 | N/A | N/A |
| 1967 | 14 | 22 | 35 | 51 |
| 1970 | 16 | 24 | N/A | N/A |

**Source:** Bureau of the Census *1971 Survey of Manufactures.*

Table I-15 also shows that the larger firms:

- are more active in state and interstate highway work while doing less private and commercial business;
- tend to derive a smaller portion of their revenues from resurfacing and maintenance work;
- realize lower prices for their material, emphasizing their efficiencies and level of vertical integration; and
- are able, therefore, to increase their market share through competitive pricing.

There are essentially three patterns of ownership and management in the industry. At the highest level of sophistication are the major companies who operate as wholly-owned subsidiaries of major corporations. Employees of these firms have no direct equity interest in their corporation, although they may have a minor equity interest in their parent company. Their plants are managed on a highly professional basis, under the strict financial control of both the subsidiary and the parent corporation.

At the second level are the publicly held corporations whose primary business is in the industry. These firms are few in the asphalt paving industry, and their stock may be closely held by the founders or their families. They are distinguished from the smaller closely-held concerns in their scope of operation, which is multi-plant, and subject to professional management and control. Plant managers for these firms will be unlikely to have a major equity interest in the corporation.

The third level is the small owner-managed firms. The majority of these firms may be incorporated, but the stock of the corporation will be closely held. They will operate one

TABLE I-15

HOT-MIX ASPHALT PRODUCTION OF REPORTING COMPANIES GROUPED BY VOLUME OF PRODUCTION

| | | | Group I Under 100,000 tons | Group II 100,000-199,999 tons | Group III 200,000-499,999 tons | Group IV 500,000 and Over | Total* |
|---|---|---|---|---|---|---|---|
| Hot Mix Asphalt Production Value and Change | Reported Total Production (million tons) | | 9 | 13 | 30 | 38 | 90 |
| | Reported Total Value (million dollars) | | $58 | $91 | $183 | $229 | $562 |
| | Average Value Per Ton FOB Plant | | $6.76 | $6.89 | $6.13 | $5.99 | $6.27 |
| | Change in Production 1971 – 1972 | | -7% | 0 | +9% | +5% | +5% |
| Distribution of 1972 Production | Markets | Interstate Highways | 1% | 6% | 18% | 20% | 16% |
| | | State Highways | 28% | 29% | 32% | 30% | 30% |
| | | Municipal and County Roads | 29% | 26% | 19% | 20% | 21% |
| | | Airports | 2% | 3% | 3% | 3% | 3% |
| | | Private and Commercial | 38% | 33% | 27% | 25% | 28% |
| | | Other | 2% | 3% | 1% | 2% | 2% |
| | End Uses | Surface and Binder | 75% | 68% | 70% | 62% | 67% |
| | | Hot mix base | 17% | 26% | 27% | 33% | 28% |
| | | Patching | 5% | 5% | 2% | 4% | 4% |
| | | Other | 3% | 1% | 1% | 1% | 1% |
| | Type of Construction | New Construction | 51% | 51% | 55% | 57% | 55% |
| | | Resurfacing and Maintenance | 49% | 49% | 45% | 43% | 45% |
| Number of Companies and Plants | Number of Reporting Companies | | 155 | 95 | 97 | 41 | 388 |
| | Number of Stationary Plants Covered | | 154 | 133 | 241 | 295 | 823 |
| | Number of Portable Plants Covered | | 57 | 44 | 78 | 79 | 258 |

*Totals may not add due to rounding.

**Source:** *Hot Mix Asphalt, Plant and Production Facts, 1972,* National Asphalt Paving Association.

plant or a small number of plants, in a very limited geographical region. Plant management, which will often be the same as the firm management, will generally have a significant equity interest in the operations. Table I-16 lists selected statistics on plant ownership for SIC 2951.

The pattern of ownership may have a direct bearing on the response of the firm to the economic impact of pollution control. In general, closely held firms will be less likely to be able to raise capital externally if such is required to install pollution control equipment. Also, the potential of closure to them would have a much greater personal significance than to the professional managers of a corporate subsidiary.

Companies also differ as to degree of integration in the entire paving process. Although some companies (SIC 2951) are primarily producers of asphalt paving materials, the great majority of the 4,800 companies in the industry also engage in contract work. Nearly half of the companies have integrated backwards into controlling sources of gravel and other aggregates. A growing proportion of the companies in the asphalt paving business also distribute asphalt emulsions and other liquid asphalt products. Table I-8 has detailed certain statistics on integration compiled by the National Asphalt Paving Association for the 388 companies covered in its annual survey.

c. Industry Segmentation

Segmentation within the asphalt concrete and emulsion industries, except for plant size, is insignificant for the purposes of this economic impact analysis. In the asphalt concrete industry, there is some geographic segmentation as to production period; plants in the northern regions are generally shut down during the winter months, because it is not feasible to lay hot-mix asphalt in cold temperatures. Plants in the South and Southwest normally operate year-round. As inter-regional shipment is unlikely, this segmentation has no effect on the industry as a whole.

### 3. Financial Profile

Because of the large number of privately held firms and the significant degree of vertical integration within the asphalt paving industry, little data has been published on the financial characteristics of asphaltic concrete and emulsion plants. The figures presented here are a combination of total industry data derived from the Bureau of the Census for SIC 2951 and data obtained from industry sources.

Tables I-17 and I-18 give selected financial statistics and operating ratios for SIC 2951 from 1963 to 1972. They show a healthy growing industry characterized by the following trends:

- A steady increase in dollar volume of shipments.
- Commensurate growth in capital expenditures.

TABLE I-16

SIC 2951 SELECTED STATISTICS FOR OPERATING MANUFACTURING ESTABLISHMENTS, BY TYPE OF OPERATION AND LEGAL FORM OF ORGANIZATION FOR MAJOR INDUSTRY GROUPS AND INDUSTRIES (1967)

| Item | Number of Establishments | Total Number of Employees* | Total Number of Production Workers* | Value Added By Manufacture** | Value of Shipments** | Capital Expenditures, New** |
|---|---|---|---|---|---|---|
| Total SIC 2951 | 872 | 12.2 | 8.5 | 234.7 | 584.6 | 23.8 |
| Type of Operation: | | | | | | |
| Total Multiunit Companies | 461 | 6.6 | 4.5 | 140.4 | 366.7 | 14.3 |
| Total Single Unit Companies | 286 | 5.2 | 3.7 | 88.1 | 202.5 | 8.8 |
| Legal Form of Organization: | | | | | | |
| Corporate | 689 | 11.3 | 7.8 | 219.9 | 549.5 | 22.5 |
| Total Noncorporate | 58 | 0.5 | 0.4 | 8.5 | 19.7 | 0.6 |
| Establishments Covered by Administrative Records*** | 125 | 0.3 | 0.3 | 6.2 | 15.3 | 0.7 |

* Thousand

** Millions of Dollars.

*** No Data on type of operation or legal form of ownership.

**Source:** *1972 Census of Manufactures*, U.S. Department of Commerce, Bureau of the Census.

TABLE I-17

SELECTED STATISTICS SIC 2951 (1963-1971)

| Year | All Employees | | Production Workers | | Value Added** | Cost of Materials** | Value of Shipments** | Capital Expenditures** | End-of Year Inventories** |
|---|---|---|---|---|---|---|---|---|---|
| | Number* | Payroll** | Number* | Wages** | | | | | |
| 1963 | 9.7 | 62.1 | 6.7 | 40.0 | 165.6 | 261.8 | 427.5 | 15.1 | 12.1 |
| 1964 | 9.9 | 64.2 | 6.8 | 41.3 | 160.7 | 283.8 | 442.7 | 13.5 | 13.4 |
| 1965 | 10.1 | 67.5 | 7.4 | 44.7 | 183.6 | 279.6 | 461.9 | 19.9 | 14.7 |
| 1966 | 10.4 | 70.5 | 7.7 | 46.9 | 185.9 | 293.6 | 479.2 | 20.1 | 14.5 |
| 1967 | 12.2 | 90.0 | 8.5 | 58.4 | 234.7 | 350.1 | 584.6 | 23.8 | 19.7 |
| 1968 | 11.6 | 89.4 | 8.2 | 58.3 | 243.8 | 370.5 | 610.9 | 23.0 | 22.9 |
| 1969 | 11.6 | 97.0 | 7.9 | 64.1 | 260.9 | 380.2 | 641.5 | 27.9 | 22.7 |
| 1970 | 12.9 | 117.2 | 8.8 | 72.3 | 320.4 | 417.8 | 738.4 | 30.4 | 27.4 |
| 1971 | 12.4 | 126.2 | 7.9 | 75.7 | 345.2 | 464.6 | 803.6 | 35.3 | 30.4 |
| 1972 | 13.4 | 142.6 | 9.7 | 97.6 | 388.1 | 502.3 | 883.0 | 54.0 | 37.4 |

*Thousands.

**Millions of Dollars.

**Source:** *1972 Preliminary Census and 1971 Survey of Manufactures*, U.S. Department of Commerce, Bureau of the Census.

TABLE I-18

SELECTED OPERATING RATIOS SIC 2951 (1963-1971)

| Year | Ratio of Value Added to Shipments | Ratio of Inventories to Shipments | Ratio of Payroll to Value Added | Wage Per Production Worker Manhour ($) | Value Added Per Production Worker Manhour ($) | Index of Employment (1967=100) | Value Added (1967=100) | Index of Shipments (1967=100) |
|---|---|---|---|---|---|---|---|---|
| 1963 | 0.387 | 0.028 | 0.375 | 2.649 | 10.97 | 79.51 | 70.56 | 73.13 |
| 1964 | 0.363 | 0.030 | 0.400 | 2.735 | 10.64 | 81.15 | 68.47 | 75.73 |
| 1965 | 0.397 | 0.032 | 0.368 | 2.811 | 11.55 | 82.79 | 78.23 | 79.01 |
| 1966 | 0.388 | 0.030 | 0.379 | 3.148 | 12.48 | 85.25 | 79.21 | 81.97 |
| 1967 | 0.401 | 0.034 | 0.383 | 3.244 | 13.04 | 100.00 | 100.00 | 100.00 |
| 1968 | 0.399 | 0.037 | 0.367 | 3.470 | 14.51 | 95.08 | 103.88 | 104.50 |
| 1969 | 0.407 | 0.035 | 0.375 | 3.601 | 14.66 | 95.08 | 111.16 | 109.73 |
| 1970 | 0.434 | 0.037 | 0.366 | 3.866 | 17.13 | 105.74 | 136.51 | 126.31 |
| 1971 | 0.430 | 0.038 | 0.366 | 4.588 | 20.92 | 101.64 | 147.08 | 137.46 |
| 1972 | 0.440 | 0.042 | 0.367 | 4.692 | 18.66 | 109.84 | 165.36 | 151.04 |

Source: *1972 Preliminary Census of Manufactures, and 1971 Survey of Manufactures*, U.S. Department of Commerce, Bureau of the Census

- Increasing wages and productivity.
- Value added growing faster than sales volume.

Figure I-2 graphically displays selected features of the operating profile. The statistics on the larger industry (including SIC 1611) listed in Table I-4 indicate that these positive trends are also typical of that sector.

Table I-19 demonstrates the steady improvement in gross profit margins which the industry has experienced over the decade. There is evidence, however, that these margins have slipped in the last year, for reasons which are discussed in detail in the following section.

**TABLE I-19**

FINANCIAL PROFILE - SIC 2951

| | 1971* | Percent | 1967* | Percent | 1963* | Percent |
|---|---|---|---|---|---|---|
| Sales | 803.6 | 100.0 | 584.6 | 100.0 | 427.5 | 100.0 |
| Cost of Goods Sold: | | | | | | |
| Materials | 464.6 | 57.8 | 350.1 | 59.9 | 261.8 | 61.2 |
| Labor | 75.7 | 9.4 | 58.4 | 10.0 | 40.0 | 9.4 |
| Total Cost of Production | 540.3 | 67.2 | 408.5 | 69.9 | 301.8 | 70.6 |
| Operating Profit | 263.3 | 32.8 | 176.1 | 30.1 | 125.7 | 29.4 |

*Millions of Dollars.

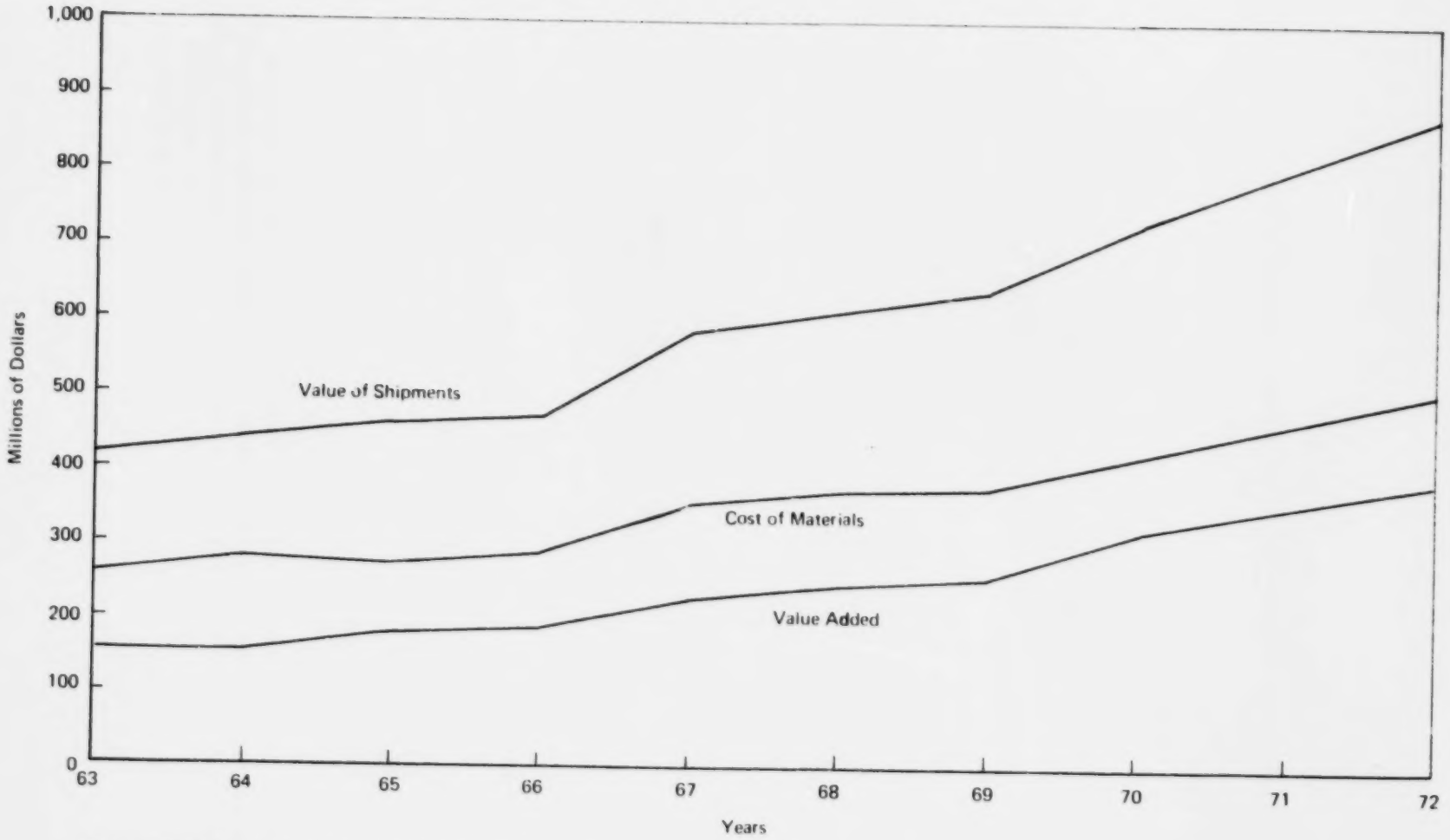
**Source:** *Annual Survey of Manufactures, 1971*, U.S. Bureau of Census.

From the above data and data gleaned from interviews with industry sources, a typical operating statement for an asphalt concrete plant has been prepared and is shown in Table I-20. Profit levels in the industry, both as a percentage of sales and as a percentage of owner's equity or net assets are somewhat below the national averages of 4.3% and 10.6%, respectively, for all manufacturing companies.

Published data on emulsion plants, unfortunately, are not available. However, industry estimates suggest a financial profile in line with that presented in Table I-21.

### 4. Prices and Price Setting

An important factor in determining the ability of an industry to mitigate the effect of incremental costs for pollution control is its flexibility in raising prices to cover these incremental costs. This section analyzes historical trends in prices of asphalt paving products and examines the pricing practices in the industry to provide a basis for assessing the economic impact on the industry of the proposed effluent limitation Guidelines.




**Source:** 1972 Preliminary Census and 1971 Survey of Manufactures, U.S. Department of Commerce, Bureau of the Census.

**FIGURE I-2 SELECTED STATISTICS SIC 2951 (1963-1971)**

**TABLE I-20**

**AVERAGE OPERATING STATEMENT FOR ASPHALT CONCRETE PLANTS (1972)**

| | | Percent of Sales |
|---|---|---|
| Net Sales, After Discounts, etc. | | 100.0 |
| Direct Manufacturing Costs | | |
| Aggregates | 31.0 | |
| Asphalt Cement | 24.0 | |
| Other | 3.0 | |
| Labor & Operating Expenses | 9.0 | 67.0 |
| Indirect Manufacturing Costs | | 13.0 |
| Gross Profit | | 20.0 |
| Selling, General & Administrative Expenses | | 13.0 |
| Profit Before Tax | | 7.0 |
| Net Profit After Tax | | 4.0 |
| Return On Net Assets | | 8.0 |
| Return On Owners Equity | | 10.0 |

**Note**: These historical relationships have been altered to a degree in recent months, because producers have had difficulty in passing on the increased cost of their raw materials. However, as this situation stabilizes, profit levels should return to the range indicated above.

**Source**: Contractor estimates.

As with most materials, the prices of asphalt concrete and emulsions are determined by cost of production and the prices of substitute products. The production factor which historically has had the greatest effect on asphalt paving materials is the cost of asphalt cement. The primary competing material which has served to control increases in the prices of asphalt concrete and emulsions in Portland cement concrete.

Table I-22 shows the historical relationship between the price of asphalt concrete and Portland cement concrete installed on federal-aid highway programs. The third column in the table demonstrates that the relationship between the price of these two materials has remained remarkably constant over the 18-year price history covered. These prices, it is important to note, include shipping costs from the plant to the job site, and the labor and machinery required to install the material at the job site.

TABLE I-21

AVERAGE OPERATING STATEMENT FOR ASPHALT EMULSION PLANTS (1972)

| | | Percent of Sales |
|---|---|---|
| Net Sales, after discounts, etc. | | 1000 |
| Direct Manufacturing Costs | | |
| Asphalt Cement | 39.0 | |
| Other Materials | 14.0 | |
| Direct Labor | 12.0 | 65.0 |
| Indirect Manufacturing Costs | | 13.0 |
| Gross Profit | | 22.0 |
| G, S&A | | 13.0 |
| Profit before Tax | | 9.0 |
| Net Profit After Tax | | 5.0 |
| Return of Net Assets | | 12.0 |
| Return on Equity | | 15.0 |

**Source:** Contractor Estimates.

TABLE I-22

AVERAGE BID PRICE TRENDS ON FEDERAL AID HIGHWAY CONTRACTS
(Dollars per Short Ton)

| Year | Asphalt Concrete | Portland Cement Concrete | Ratio of Portland Cement Concrete to Asphalt Concrete |
|---|---|---|---|
| 1955 | 6.07 | 3.96 | 0.65 |
| 1960 | 6.37 | 4.33 | 0.68 |
| 1965 | 6.50 | 4.34 | 0.67 |
| 1967 | 6.47 | 4.43 | 0.68 |
| 1970 | 8.04 | 5.42 | 0.67 |
| 1971 | 8.54 | 6.06 | 0.71 |
| 1972 | 9.22 | 6.25 | 0.68 |
| 1973 | 9.99 | 6.87 | 0.69 |

**Source:** *Engineering News Record*, Various issues.

On a per-mile-of-highway-installed basis, asphalt concrete generally has a lower first cost than Portland cement concrete. A study done in 1961 by the Stanford Research Institute, indicated that the cost of a heavy-duty asphalt surface averaged $60,000 per mile of construction, while a similar Portland cement concrete surface averaged $80,000 per mile. While Portland cement concrete is generally cheaper on a per ton basis, as shown in Table I-22, a greater depth is required for Portland cement concrete (4"-6" vs. 3" for asphalt concrete). As the specific gravities of the materials are roughly equivalent, the material cost advantage is largely offset. Portland cement concrete thus requires from 33% to 100% more product per mile than asphalt concrete. This difference was offset to a degree by the longer life of a concrete surface, 26 years versus 18 years for asphalt.

Since the price relationship of the raw materials has remained constant over the past 18 years, as demonstrated in Table I-22, and the other factors of installed cost are either common to both systems (road base), or have risen in cost concomitantly (rebar), one can assume that this first-cost relationship has remained at least constant over the last decade. The decision to purchase asphalt or concrete, therefore, depends on the discount rate used to evaluate the longer-term savings of concrete in terms of lesser frequency of resurfacing. In recent years, as interest rates have risen, the competitiveness of asphalt can be said to have increased. This may explain, to a large degree, the increase in market share of asphalt on federal-aid highway programs mentioned previously.

Table I-23 compares the price of asphalt concrete, FOB plant, and installed for 1970-1972. This table suggests that recent price increases have been caused more by increases in the cost of installation than in the cost of the asphalt concrete FOB plant.

The two primary cost of production factors which have a significant bearing on the price of asphalt concrete are aggregates and asphalt cement. Table I-20 gave an indication of the relative importance of these two materials in the cost structure of asphalt concrete. Table I-24 gives an indication of materials usage within SIC 2951. For emulsions, asphalt cement is the primary cost factor.

While the importance of aggregates and asphalt cement historically have been of equal importance in the cost of asphalt concrete, asphalt cement has been the major factor in the price increases of the past few years. One reason for this, as shown in Table I-8, is that a good proportion of companies in the asphalt concrete business control their own quarries, and therefore, the price of aggregates can be controlled concomitantly. Despite the presence of major oil companies in the industry, the price of asphalt cement to the paving companies is largely out of the control of the asphalt producers.

Table I-25 lists the relationship between the price of asphalt cement and the price of asphalt concrete for the past three years. It illustrates that in recent years other elements of cost (primarily labor) have played a larger role in the price increases, as reported in Table I-22. Recently, this trend has been reversed. Current prices for asphalt cement have reached as high as $81 per short ton. Such an increase of $50 in the price of asphalt cement from

## TABLE I-23

## ASPHALT CONCRETE PRICES
(Dollars per Short Ton)

| Year | Material, FOB Plant | Installed | Material Proportion of Cost |
|---|---|---|---|
| 1970 | 5.79 | 8.04 | 72% |
| 1971 | 6.08 | 8.54 | 71% |
| 1972 | 6.27 | 9.22 | 68% |

**Sources**: National Asphalt Paving Association and *Engineering News Record*, various issues.

## TABLE I-24

## MATERIALS CONSUMED BY THE ASPHALT PAVING INDUSTRY (1967)

| Material | Unit of Measure | Quantity | Delivered Cost* |
|---|---|---|---|
| Total Materials, Containers, and Supplies | | N/A | 301.9 |
| Asphalt: | | | |
| Less than 200 Penetration | 1,000 Short Tons | 4,761.4 | 104.5 |
| 200 and Over Penetration | Million bbls. | N/A | 11.0 |
| Sand and Gravel | 1,000 Short Tons | 35,354.6 | 59.9 |
| All Other Materials, and Components, Parts, Containers, and Supplies Consumed | | N/A | 61.9 |
| Materials, Containers and Supplies, other | | N/A | 64.6 |

*Millions of Dollars.

**Source**: *1967 Census of Manufactures*, U.S. Department of Commerce, Bureau of the Census.

$31 in 1972 (Table I-25) can be expected to increase the cost of asphalt concrete by $50/18 or $2.78 per short ton. Fortunately for the industry, the price of Portland cement concrete has also been severely affected by the energy crisis, not through raw material costs, but through production costs, because the cement industry is highly energy intensive; a modern facility incurs 35% of its manufacturing cost on fuel and power. (The cement industry, of course, has also been burdened with considerable emission control costs that have sharply increased total costs or made plants obsolescent.)

**TABLE I-25**

**RELATIVE AVERAGE PRICES (Asphalt Concrete)**
**(Dollars Per Short Ton)**

| Year | Asphalt Concrete | Asphalt Cement | Asphalt Cement ÷ 18 | Δ Asphalt Concrete | Δ Asphalt Cement ÷ 18 |
|---|---|---|---|---|---|
| 1968 | 5.38 | 23.10* | 1.28 | | |
| 1970 | 5.79 | 29.08 | 1.62 | 0.41 | 0.34 |
| 1971 | 6.08 | 30.48 | 1.69 | 0.29 | 0.07 |
| 1972 | 6.27 | 31.02 | 1.72 | 0.19 | 0.03 |

*1969

**Sources:** National Asphalt Paving Association and *Engineering News Record*, various issues.

An indication of the rapidity of recent price increases in asphalt cement can be obtained from *Engineering News Record*. On December 6, 1973, the average price reported for asphalt cement of 85/100 penetration was $32.78. A more recent average price, is about $60 in July 1974 although prices may vary from $45-80, depending on contract commitment and location. The emulsions sector, whose primary raw material is asphalt cement, has seen more dramatic price rises than the asphalt concrete sector. However, its primary competing material, cutbacks, are similarly dependent upon asphalt cement as a raw material, so its relative market position has not been severely affected. Table I-26 shows the average prices of emulsions and cutbacks for selected dates from January 1972 to the present.

As mentioned previously, asphalt paving products are sold primarily on a bid basis for specific projects. Because of the relatively stable price history of asphalt products until the past few years, contractors and producers were willing to submit firm bids for projects such as state and federal highway contracts which might commence a year or 18 months

TABLE I-26

RELATIVE AVERAGE PRICES (Emulsions)
(Dollars per Gallon)

| Date | Asphalt Emulsions | Asphalt Cutbacks |
|---|---|---|
| January 1972 | 0.157 | 0.143 |
| July 1973 | 0.173 | 0.148 |
| December 1973 | 0.195 | 0.167 |
| March 1974 | 0.247 | 0.236 |
| August 1974 | 0.332 | 0.322 |

**Source**: *Engineering News Record*, various issues.

subsequent to the establishing of the bid price. This practice has recently caused severe difficulties for the industry; companies are forced in many cases to supply their product at a price determined on the basis of an asphalt cement price of $30 per short ton, although their current costs for the asphalt cement may be $50-70 per ton.

There is a growing movement in the industry to introduce escalation clauses in their long-term contracts which will protect them against future price increases in the costs of its raw materials. Opposition to this idea is expected from the governmental agencies which would be forced to pay the increased costs under such a contract.

Complexities in the current pricing guidelines for the oil industry have also disturbed the traditional pricing practices of the industry. Because of the supply problems in the oil industry, suppliers of asphalt cement in several locations are refusing to take new customers. Under current pricing guidelines the cost of asphalt cement at the refinery may vary as much as $20 per ton between suppliers. The paving plants which have been supplied traditionally by the refineries whose prices are currently high are unable to buy the product from the lower-cost refineries. Consequently, they are at a severe pricing disadvantage vis-a-vis the producer who may continue to purchase his asphalt cement from these lower-cost refineries.

## B. PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS

The proposed effluent limitations for the asphalt paving industry are detailed in Tables I-27 and I-28 and have been described by the Guidelines contractor as follows:

"*Asphalt Emulsion Plants*

"*Best Practicable Control Technology Currently Available*

TABLE I-27

EFFLUENT LIMITATIONS FOR ASPHALT EMULSION PLANTS
(6000 tons per day)

| | Suspended Solids* | | Oils and Grease* | |
|---|---|---|---|---|
| | 30-Day Average lbs/1000 gal | Maximum Daily lbs/1000 gal | 30-Day Average lbs/1000 gal | Maximum Daily lbs/1000 gal |
| Best Practicable Control Technology Currently Available | not regulated | not regulated | 0.125 | 0.167 |
| Best Available Technology Economically Achievable | 0.125 | 0.188 | 0.083 | 0.125 |
| Standards of Performance for New Sources | 0.125 | 0.188 | 0.083 | 0.125 |

Note: pH within the Range of 6.0-9.0

*Data based on containment of runoff from an average plant site of 10 acres with an average rainfall of 3 inches per day, or 0.800 MGD. The limits are also based on weight of pollutant per volume of runoff water.

**Source**: Development Document.

TABLE I-28

EFFLUENT LIMITATIONS FOR ASPHALT CONCRETE PLANTS
(Capacity 1600 short tons/day; Production 600 tons/day for 188 days)

| | Suspended Solids | |
|---|---|---|
| | 30-Day Average lb/ton | Maximum Daily lb/ton |
| Best Practicable Control Technology Currently Available | Recycle | Recycle |
| Best Available Technology Economically Achievable | | |
| Standards of Performance for New Sources | Recycle | Recycle |

**Note**: recycle is equivalent to no discharge.

**Source**: Development Document.

"All runoff from the plant production area should be collected and treated. Installation and operating costs that would be incurred at a typical size plant, one having a 6,000 short ton per day capacity, are presented in Table 11.* The production area is assumed to cover 10 acres. The production area is defined as that area in which the oxidized asphalt and asphalt emulsions are produced and from which they are shipped. It was also assumed that the most rain that would fall during a 24-hour period is three inches. It was further assumed that a peripheral collection system is necessary and that a gravity separator is needed to treat the runoff.

*"Best Available Technology Economically Achievable*

"BATEA for the asphalt emulsion plant consists of a sedimentation basin where additional removal of oils and suspended solids can be achieved. The incremental costs of achieving BATEA are shown in the second column of Table 11."

Pretreatment standards for new emulsion plants would be similar in technology and cost to BPT standards for oil and grease; those for existing sources, if they were to be proposed, would be considerably less stringent.

*"Asphalt Concrete Plants*

*"Best Practicable Control Technology Currently Achievable (BPCTCA).*

"BPCTCA (identical to BATEA) calls for settling the wastewaters in an earthen stilling basin, removal and disposal of the settled solids and subsequent recycling of the water. Typical costs are presented in Table 12."

The proposed Guidelines will apply only to those existing plants that have elected to use wet processes in the control of particulate emissions, or those new plants which choose to do so. As mentioned earlier, approximately 25% of the existing plants use a dry process for particulate control, and therefore will not be affected by the proposed effluent Guidelines. It is projected that virtually all new plants will use the dry, or "baghouse," process for particulate control. The primary concern in this impact analysis, therefore, will be the approximately 3,600 plants which are equipped with wet process control equipment.

---

* Tables 11 and 12 (as revised) are contained in the Development Document and are reproduced here in Tables I-29 and I-30.

TABLE I-29

TREATMENT COSTS FOR ASPHALT EMULSION PLANTS
(6,000 short tons x 250 days/year)

| Type of Cost | Technology Level | | |
|---|---|---|---|
| | BPT | BAT* | NSPS |
| Total Investment | $73,290 | $80,790 | $72,000 |
| Total Operating Maintenance and Energy | 1,440 | 2,165 | 1,440 |
| Total Annual** | 16,098 | 18,323 | 15,840 |
| Cost Per Short Ton | 0.011 | 0.012 | 0.011 |

* Cumulative costs incurred after BPT has been achieved.

** Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). 15% was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

**Source:** Development Document.

TABLE I-30

TREATMENT COSTS FOR ASPHALT CONCRETE PLANTS
(BPT, BAT and NSPS)

| Type of Cost | Plant Size* | | |
|---|---|---|---|
| | Small (1000 short tons/day) | Average (1600 short tons/day) | Large (2500 short tons/day) |
| Investment | $4,600 | $ 5,550 | $ 6,400 |
| Total Operating, Maintenance and Energy | 7,075 | 9,365 | 12,925 |
| Annual Cost | 7,995 | 10,475 | 14,205 |
| Cost per Short Ton** | 0.113 | 0.093 | 0.081 |

*Annual production assumed at 188 days/year, 3 hours/day.

**Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). 15% was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

**Source:** Development Document.

## C. ECONOMIC IMPACT ANALYSIS

### 1. Price Effects

#### a. Emulsions

Presuming that the incremental costs of meeting proposed effluent limitation Guidelines are passed through directly to the customers of this sector of the industry, with a markup on the increment sufficient for the sector to retain its historic level of profitability, the effect of BPT Guidelines will be to increase the selling price of asphalt emulsions by 0.03% for the average sized plant. This increase is based on a current selling price of $63.45 per short ton (based on 250 gallons/ton) and an incremental annual cost of approximately 2¢ per ton. This percentage will not vary significantly by size of plant. It is felt that such a minimal pass-through of costs will be easily accomplished in this sector, and that, therefore, the economic impact will be negligible.

#### b. Asphalt Concrete

Presuming the same pass-through of costs and retention of current returns on net assets, the effect of BPT Guidelines will be to increase the selling price of asphalt concrete by 1.2% for the average sized plant. For the smaller plants (1,000-short-ton-per-day capacity or less) the increase will be slightly higher, or 1.5%. These percentages are based on an average selling price of $8.00 per short ton, and incremental costs of 9.3¢ per ton for the average sized plant and 11.3¢ per ton for the smaller plants (Table I-30).

Such price increases could have two types of economic impact on the asphalt concrete sector. For the sector as a whole, any price increases could place its product at a relative disadvantage with competing paving materials (primarily concrete). Within the sector, the higher relative costs to the smaller plants could make their products less competitive with those of larger plants which serve the same market area.

The first type of impact, a possible shift in market share between asphalt concrete and Portland cement concrete, should be minimal for a number of reasons. First, the wearing course material of a road or highway is only one component of the total installed cost of the surfacing. A 1% increase in the cost of asphalt concrete would increase the installed cost of asphalt concrete paving by approximately 0.4% because the base course cost and labor content of the finished surface would not be affected. Thus, the maximum shift in the installed cost of an asphalt concrete surface under the proposed Guidelines for a 1,000-ton-per-day plant (11% of the industry as demonstrated in Table I-10) would be 0.6%. Second, as discussed previously, the effect of current high interest rates is to mitigate the longer term benefits of PCC. Furthermore, the surfacing material for a highway is chosen primarily on the basis of product preference and materials availability rather than price.

Hence, it is felt that such an increase in relative price will not cause any shift in the market shares of asphalt concrete and Portland cement concrete. Moreover, Portland cement concrete plants also have air and water pollution problems, the incremental cost of control tending to mitigate any effect of the proposed Guidelines on the asphalt concrete industry. Air emission control costs alone have added an estimated 4% to the average selling price of cement. Finally, the cement industry, perhaps one of the most adversely affected by the price and wage controls, has increased selling prices by an average of 23% since the controls were lifted in November, 1973, to August, 1974, in an attempt to improve their profits.

The second type of impact, a shift in prices within the industry vis-à-vis the larger and smaller plants, will have some significance. While, because of the effect of transportation costs, smaller plants located in remote market areas are not likely to be impacted, plants located in metropolitan areas which may be served by a number of establishments will be. In areas where contractors have a number of sources of supply, price competition within the sector may be severe. The effect of the proposed Guidelines will be to make certain plants (those not using baghouses and especially the smaller plants not so equipped) less competitive. However, again because of the effect of transportation costs, which limit potential market encroachments, this shift in relative prices will be mitigated. A small number of marginal plants (10-15) may be forced to close as a result of the proposed Guidelines, but the more prevalent effect will be to reduce slightly the effective market radius of those plants most affected. In those market areas where a number of competitors exist, therefore, there could conceivably be some shift in market share from those smaller plants which must meet the Guidelines, to the larger plants.

The potential magnitude of this effect can be estimated as follows. Of the 4,750 plants in this sector, approximately 25% are equipped with dry process particulate control procedures, and therefore, will not be economically affected by the Guidelines. Of the remaining 3,600 plants, the NAPA estimates that all are equipped with wet control processes. Of these, 85%, or 3,100 plants, already settle and recycle their process water and are, therefore, in compliance with the Guidelines. Of the remaining 500 plants that will be affected by the Guidelines, the NAPA estimates the great majority are in non-urban areas; most plants in metropolitan areas find it necessary (and in some cases economic) to recycle their process water to meet local standards of effluent control and to reduce the cost of process water to them. There is no available data on the size distribution of the 500 plants which do not currently meet the proposed standards.

Plants in non-metropolitan areas can be expected to be far less impacted by the Guidelines because of the relative lack of intra-industry competition in their market areas. The minority of plants in metropolitan areas that do not recycle their process water may be affected, but this effect is not expected to be major. As discussed previously, the maximum effect on prices of the Guidelines is expected to be slightly over 1% of average selling prices, or 11.3¢ per short ton. With shipping costs averaging 13¢ per ton per mile, the reduction in

effective market radius in the worst case would be less than one mile. The theoretical effect on these smaller plants may be estimated as follows. If the incremental costs were passed on, the effective theoretical reduction in market radius of a small plant with an initial market radius of 10 miles would be 16.7%, presuming market conditions of perfect equilibrium and constant geographic density.

In the extreme case, where this might have an effect, a small plant could absorb the 1.4% cost, and operate at a reduced level of profitability, for those specific projects, without endangering the firm's existence. Under the theoretical small plant described above, with an effective market radius of 10 miles and operating under a state of perfect equilibrium, this 1.4% absorbtion of costs would occur only at the limit of its effective market radius. In the inner 83.3% of its market, where the effect of transportation costs are such that it may pass on the incremental costs without loss of market share, there would be no economic impact. In the outer 16.7% the amount of costs needed to be absorbed would range from 100% at the perimenter of the marketing radius to 0% at the point where transportation costs and incremental price are equivalent. A simplifying assumption would be that over this range the plant, on average, would have to absorb 50% of the incremental cost. The overall effect on profitability would therefore be slightly more than .1% of sales (a reduction of 1.4% x 50% for 16.7% of the market area).

Under this theoretical analysis, it would be reasonable to assume that there would be no measurable economic impact on the asphalt concrete industry as a result of the proposed guidelines. However, there are likely to be exceptions to this theoretical model. Small metropolitan plants which must meet the guidelines, and whose effective market areas may include important segments at the perimeter of the radius, will probably be subject to intense competition from one or more other plants. In such cases, the effective market share lost if costs are passed on, or the effective loss of profits if costs are absorbed may be substantial. In some cases, historical links between suppliers and customers may override purely economic factors. While lack of precise data on each of the 4,750 plants makes it impossible to determine what number of plants might fall in this category, it is highly unlikely that there would be more than 10-15.

A possible determinant as to which plants may close would be the ownership pattern of the plant. Owner-operated plants, with less access to capital, might close for this reason, although the psychological involvement of the owners will resist such closure. Plants attached to large diversified corporations, while having greater access to capital, will also be more inclined to view the closure situation in purely economic terms.

The secondary price effects of the incremental cost of the proposed Guidelines will not be significant. Just as asphalt concrete and emulsions are only a portion of the installed costs of a paving surface, so the paving surface is only a portion of the total cost of a highway, road, runway, parking lot, etc. The percentage increase in the total cost of any such project occasioned by the increased costs of the proposed Guidelines will in all cases be far less than 1%.

## 2. Financial Effects

If, as has been concluded in the previous section, the incremental costs are passed on as price increases while current returns on net assets are maintained, there will, by definition, be no effect on profitability of the plants in the industry. If, such cost pass-through is not possible, however, or it cannot be done in full, the theoretical impact of cost absorption on profits should be evaluated.

The asphalt paving industry operates at a relatively low level of profitability. Although the average plant is estimated to earn 4% after tax on net sales and 8% on net assets, the levels of profitability for individual plants may range from 10 to 15% for the most profitable, to breakeven or loss situations for some establishments. For a small plant with average profitability, the theoretical 0.12% increase in costs calculated above would reduce the level of after-tax profitability by a minimal amount (2.3%) to a level (3.9% on sales) the effect of which is not measurable. Those plants operating at marginal levels, and that might suffer an effect greater than that of the theoretical plant, such as increase in costs without corresponding price increases, might be forced to close prematurely.

Industry projections are that the next decade will see a shakeout of the marginal plants, which have been able to survive only because of the continually expanding nature of the paving business. As the interstate highway system nears completion, and the total volume of the industry stabilizes below recent high levels, it has been projected that as many as 500 plants will cease operation, for reasons totally unrelated to the costs of water pollution control. The effect, therefore, of the proposed Guidelines may be to cause 10-15 plants to close by 1977. Plants which are now marginal and foresee closure in the near future for market or other reasons may close prematurely, rather than invest the effort and capital for effluent treatment and control. In summary, while the industry as a whole should have little difficulty in passing on the costs of pollution control, a small number of plants may choose the route of closure, within the next two years, prior to the establishment of the Guidelines.

A second concern in this area is the ability of the industry to raise capital for general purposes over the long term, and, in the short term, for purposes directly related to the installation of effluent control processes. For the asphalt concrete segment, the incremental cost of meeting the guidelines is so minor (see Table I-30) that most firms will be able to fund the improvements from internally generated cash. As mentioned above, however, some marginal firms in the industry, foreseeing a decline in their business, may choose to cease operations at certain locations rather than expend even the $7,000 required for effluent control. As it is assumed that virtually all firms will be able to recover the incremental costs of meeting the guidelines, there should be little impairment of the industry's ability to raise capital for general purposes.

In the emulsions sector, the initial capital required to meet the proposed guidelines is proportionately higher. However, given the bright outlook for this segment, discussed earlier, and the ability of the sector to increase its prices to cover the amortization of the initial capital and annual operating costs, it is felt that the effluent control procedures required by the guidelines will be financed without difficulty.

### 3. Production Effects

Because the costs of implementing the proposed guidelines are not expected to occasion any significant shift in the market share of asphalt paving products, there will be no resulting effect on industry production. As mentioned previously, however, the costs in the asphalt concrete sector may accelerate the trend towards slightly greater concentration in a highly unconcentrated industry. Finally, because the industry currently operates at a low level of capacity utilization (35-40%), no effective loss of supply will occur. No production effects will occur in the emulsion sector.

### 4. Employment Effects

The direct effects on total employment in the asphalt paving industry from implementing the Guidelines will be minor, with a maximum of 50 employees affected (based on 15 plants, 3.2 employees/plant). Because the closures will be exclusively in metropolitan areas, no community impact is anticipated, and affected employees should easily be reabsorbed into the labor force. In general, however, employment in the industry can be expected to decline over the next decade, primarily because of the increasing use of automated plants, and little or no market growth.

### 5. Community Effects

No community effects are anticipated since very few employees will be affected and they can readily be absorbed into the work force.

### 6. Balance of Trade Effects

The international trade in asphalt paving products is precluded by transportation costs and technical feasibility. Consequently, there will be no effect on the U.S. balance of trade from the proposed guidelines.

# PART II: ASPHALT FELTS AND COATINGS (SIC 2952)

## A. INDUSTRY STRUCTURE

### 1. Products and Demand

#### a. Products

SIC 2952 includes a variety of products, all employing asphalt as one ingredient, used to waterproof the exterior of a building structure: asphalt saturated felts, roofing asphalts and pitches, strip shingles, coatings, pitches, cements, and many others. Tar products are now almost non-existent.

The saturated felt products are used as a water barrier and can be classified as either prepared roofings or built-up roofings. Both types are basically similar, each being made of a structural felt or fabric framework, a soft asphalt saturant for the felt, and a relatively hard coating on the surface of the felt. The felt is normally an organic fiber, although the use of glass fibers is increasing. Dry felt manufacture takes place at a location that can economically serve a number of strategically located roofing plants, or that is located close to or at an asphalt roofing plant itself. In the latter case, the plant's capacity is often related to that of the roofing plant.

Prepared roofings are prefabricated in roll, strip, or individual shingle form and represent a complete system, including a colored mineral aggregate surface, that can normally be applied by nailing directly to the building's roof without the need for additional materials or procedures. Built-up roofing consists of the saturated felt only, laid in overlapping layers on the roof (with or without an emulsion coat between layers) and then covered with mineral aggregates. Prepared roofings are invariably on pitched roofs while built-up roofings are used on flat surfaces.

Although the proposed effluent limitations Guidelines apply only to the roofing felts and impregnated roofing felts (and hence the economic impact analysis will concentrate on this segment), this SIC category also includes a wide variety of other asphalt felt and coating products that are made by the same manufacturers, often in the same facilities. These products principally include:

- Roofing asphalts and pitches, coatings, and cements: used in conjunction with built-up roofing as an adhesive between layers or as an adherent surface for the mineral aggregates.

- Smooth or mineral-surfaced roll roofing and cap sheets: employed at protrusions, junctions, edges and other non-standard locations on the roof.



Preceding page blank

- Asphalt building sidings: either in roll, shingle or board form.

b. Manufacturing Processes

The manufacturing processes for the roofing felts and impregnated roofing felts have been fully described in the Development Document. While it is not necessary to duplicate the description contained in that document, some general comparisons of the differences in process economics will be useful.

Four principal differences can be identified:

1. The dry felt used to manufacture asphalt roofing is sometimes produced in a mill located close to or at the same location as the roofing plant. These felt mills may serve a specific roofing plant exclusively, serve a number of regional roofing plants owned by the same company, or produce felt on a merchant basis for general sale. When the felt mill is located next to the roofing plant (this occurs in about 40% of the cases) the production processes and physical location of the equipment are entirely separate but the two operations may expel their process water into the same effluent stream.

2. After the felt sheet has been saturated, coated, and the mineral surface applied, it will pass through a looper whose function it is to cool the sheet to a point where it can be cut and packed without damage to the material. The hot sheet is cooled either by splashing water or by spraying a fine water jet on it. The amount of water used in this cooling procedure can thus vary from .03 to 10.1 gallons per square foot of sheet surface.

3. Depending on whether shingles or roll roofing are being made, the cooled material is fed from the finish looper either to the shingle cutting machine or to the roll roofing winder for further processing before packaging.

4. Some roofing plants, especially the more recently equipped ones, will themselves oxidize the residues from the crude petroleum distillates to manufacture the asphalt used in the roofing production process.

c. Production and Shipments

Shipments of asphalt felts and coatings in SIC 2952 have shown steady and almost uninterrupted growth over the past decade, increasing from $459.5 million in 1963 to $877.1 million in 1972, an annual rate of better than 7% (Table II-1). Of the totals, a small amount of annual sales represented products that could not reasonably be classified as asphalt felts and coatings. For example, secondary sales of $104.8 million in 1967 were

included in the aggregate sales for SIC 2952 ($597.8 million) and resulted from the distribution of asbestos and from other miscellaneous income. On the other hand, other SIC categories, principally the paint industry, also manufactured and sold $26.6 million of roofing felts and coatings in 1967.

**TABLE II-1**

**TOTAL SHIPMENTS OF ASPHALT FELTS & COATINGS: 1963-1972**
**(Millions of Dollars)**

| | Felts and Coatings | Secondary Sales* | SIC 2952 Total |
|---|---|---|---|
| 1963 | 459.5 | 68.1 | 527.6 |
| 1964 | 495.9 | 77.5 | 573.4 |
| 1965 | 511.1 | 73.9 | 585.0 |
| 1966 | 506.1 | 83.3 | 589.4 |
| 1967 | 519.4 | 78.4 | 597.8 |
| 1968 | 543.7 | 89.7 | 633.4 |
| 1969 | 589.9 | 64.8 | 654.7 |
| 1970 | 626.4 | 64.8 | 691.2 |
| 1971 | 825.9 | 53.9 | 879.8 |
| 1972 | 877.1 | 127.4 | 1004.5 |

*For example, asbestos products.

**Source:** Bureau of Census, Annual Surveys and 1972 Preliminary Census of Manufactures.

The principal products shipped each year are asphalt and tar roofings and sidings. These products represent roughly 75% of all group shipments each year and totalled $668.0 million in 1972 (Table II-2). The second most important category -- roofing asphalts and pitches, coatings and cements -- totalled $153 million in that year, with the remaining products representing only $52 million. The value of shipments of asphalt roofings (not including sidings) is available only for Census years but totalled $312.1 million in 1967 -- 60% of SIC 2952 felts and coatings -- and $582.6 million in 1972 (66%).

In quantitative terms, roofings and sidings are shown either in short tons or in squares (100 square feet). Because the average weight per square foot can vary from year to year and between products, the most equitable basis of comparison is weight. Asphalt roofing tonnage shipments totalled 89.7% of all asphalt and tar roofing and siding products shipped in 1972 (Table II-3), with saturated felts a further 9.6% and asphalt siding and insulated siding less than 1%. Sales of asphalt roofing have grown at 6.2% per year on a tonnage basis from 1963 to 1972. Shipments by geographic area in 1972 were as follows:

TABLE II-2

SHIPMENTS OF ASPHALT FELTS AND COATINGS
BY PRODUCT TYPE, 1967-1972
(Millions of Dollars)

| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|---|---|---|---|---|---|---|
| Asphalt and tar saturated felts and boards for nonbuilding use | 27.5 | 34.2 | 39.1 | 17.2* | 19.8 | 32.9 |
| Roofing asphalts and pitches, coatings, and cements | 101.4 | 121.9 | 142.4 | 133.0 | 153.7 | 154.7 |
| Asphalt and tar roofing and siding products | 375.2 | 385.8 | 406.8 | 464.6 | 638.5 | 668.0 |
| Asphalt felts and coatings, n.s.k. | 15.3 | * | 1.6 | 11.6* | 13.9 | 23.3 |
| Total | 519.4 | 543.7 | 589.9 | 626.4 | 825.9 | 877.1 |

*Standard error of estimate greater than 20%

**Source:** Bureau of Census, Annual Surveys and Census of Manufactures.

TABLE II-3

SHIPMENTS OF ASPHALT AND TAR ROOFING AND SIDING PRODUCTS, 1972
(Thousands)

| | No. of Squares | Short tons |
|---|---|---|
| **United States, Total** | 99,094 | 9,357 |
| Asphalt roofing, total | 97,696 | 8,390 |
| Smooth-surfaced roll roofing and cap sheet | 22,274 | 585 |
| Mineral-surfaced roll roofing and cap sheet | 13,193 | 579 |
| Strip shingles | 59,295 | 6,918 |
| Self-sealing | 52,117 | 6,055 |
| Standard or regular, total | 7,178 | 863 |
| Individual shingles | 2,935 | 308 |
| Asphalt sidings | 136 | 7 |
| Insulated sidings, all types and finishes | 367 | 66 |
| Saturated felts, total | 895 | 895 |
| Asphalt | 859 | 859 |
| Tar | 36 | 36 |

**Source:** U.S. Department of Commerce, Current Industrial Reports MA – 29A (72)-1

| | |
|---|---|
| Northeast | 18.9% |
| North Central | 30.2 |
| South | 37.9 |
| West | 13.0 |

Imports and exports have been at a very low level. Exports have ranged from $3.12 million to $5.76 million in the period 1970-1972; imports, from $0.63 million to $4.77 million. In each case, the proportion is less than 0.6% of domestic shipments. The nature of the product and the low value-to-weight ratio make it uneconomic to ship roofing products over long distances and most trade has been with Canada.

d. Markets and Future Growth

Apart from about 2.5% of industry sales going to nonbuilding, principally automotive, applications, and a further 5% being used for building sheathings and sidings, the bulk of industry shipments find an end market in roofing applications. It is estimated that 30% of all roofing products in this industry sector is used for non-residential building construction, with the remainder for residential roofing. Re-roofing of residential structures is an extremely important segment of the market and has represented a load-leveling base for industry sales in years when new housing starts have been relatively low. Residential re-roofing thus ranges from approximately 55% of all residential roofing, in a good year for new residential construction, to 75% in an off year. While the variations are not quite so dramatic in non-residential roofing, re-roofing also represents about 65% of all roofing sales to the non-residential segment.

Companies manufacturing asphalt roofings find intra-industry competition more severe than that with other materials. In residential construction, the only other significant roofing material is that of wood shingles and shakes, possibly representing 10% of all residential roofing sales and now enjoying a modest comeback as an architectural style with mansard designs. Competition for asphalt roofings in non-residential construction includes a very small amount (less than 5%) of hypalon and other rubber/plastic compounds, as well as a far larger proportion of metal roofs in farm and rural areas.

Real growth of residential roofing products in the period 1972-1980 will be affected only moderately by the small increase in new housing starts anticipated over the same period. Re-roofing of existing structures will allow the industry to maintain an annual rate of growth of at least 3.5% over the remainder of the decade. Shipments of roofing products to the non-residential building sector will enjoy a faster rate of growth, approximately 4.5% per year, which in part is a reflection of the better opportunities anticipated in new non-residential construction. Thus, overall growth of this industry sector should be close to 4% on a weighted basis to 1980. As the industry is now operating at or close to the maximum effective capacity, new plants or expansions of existing ones are a necessity.

e. Marketing and Distribution

Roofing materials are promoted through manufacturers' salesmen who serve wholesalers in principal cities throughout the United States. Little or no marketing effort is expended on direct sales to the architect, roofing contractor or homebuilder although all three will rate special attention on major projects and will be reached through advertising campaigns, mailings, trade shows and specialist publications. Manufacturers tend to specialize in prepared or in built-up roofing, and brand identification is prevalent in the former. Purchasers of built-up roofing are relatively more price conscious than those of prepared shingles as the product is a true commodity and competition between contractors for new or replacement work is strong.

Roofing plants are located close to or in heavily populated areas of the country and thus manufacturers' warehouses remote from the plant are seldom used for distribution. Wholesalers and a few of the very large retail dealers will handle an inventory but most roofing contractors will purchase on a project-by-project basis and not invest in stock. Manufacturing plants will serve a radius of 200-300 miles by truck in populated areas but distances can be greater than that in less populated regions. Roofing has a relatively low value per unit weight and thus freight can make the shipment uneconomic in competition with other plant locations. Published dealer price lists include an allowance for freight cost but freight equalization takes place when delivered price is quoted.

## 2. Manufacturing and Ownership Profile

a. Plant Characteristics

The industry is comprised of approximately 233 manufacturing establishments throughout the United States, about 108 of which produce dry and saturated roofing felts whereas the remainder concentrate on asphalts, coatings and cements. Detailed data on these facilities, showing typical characteristics of employment, value added, cost of materials, capital expenditures, etc., are shown in Table II-4 for 1963 to 1972. Figure II-1 graphically displays selected data from the operating profile. Some highlights of these data include:

- Production workers represent about 72% of total employment.
- The average number of employees per establishment was 67 in 1972; the ratio would be about 50% higher if only felt saturating plants were included.
- The value added per man-hour of production worker has been steadily increasing and totalled $16.64 in 1972, 72% higher than in 1967.
- The number of man-hours worked remained fairly constant at about 23.5 million to 1971 but increased to 26.4 million in 1972.

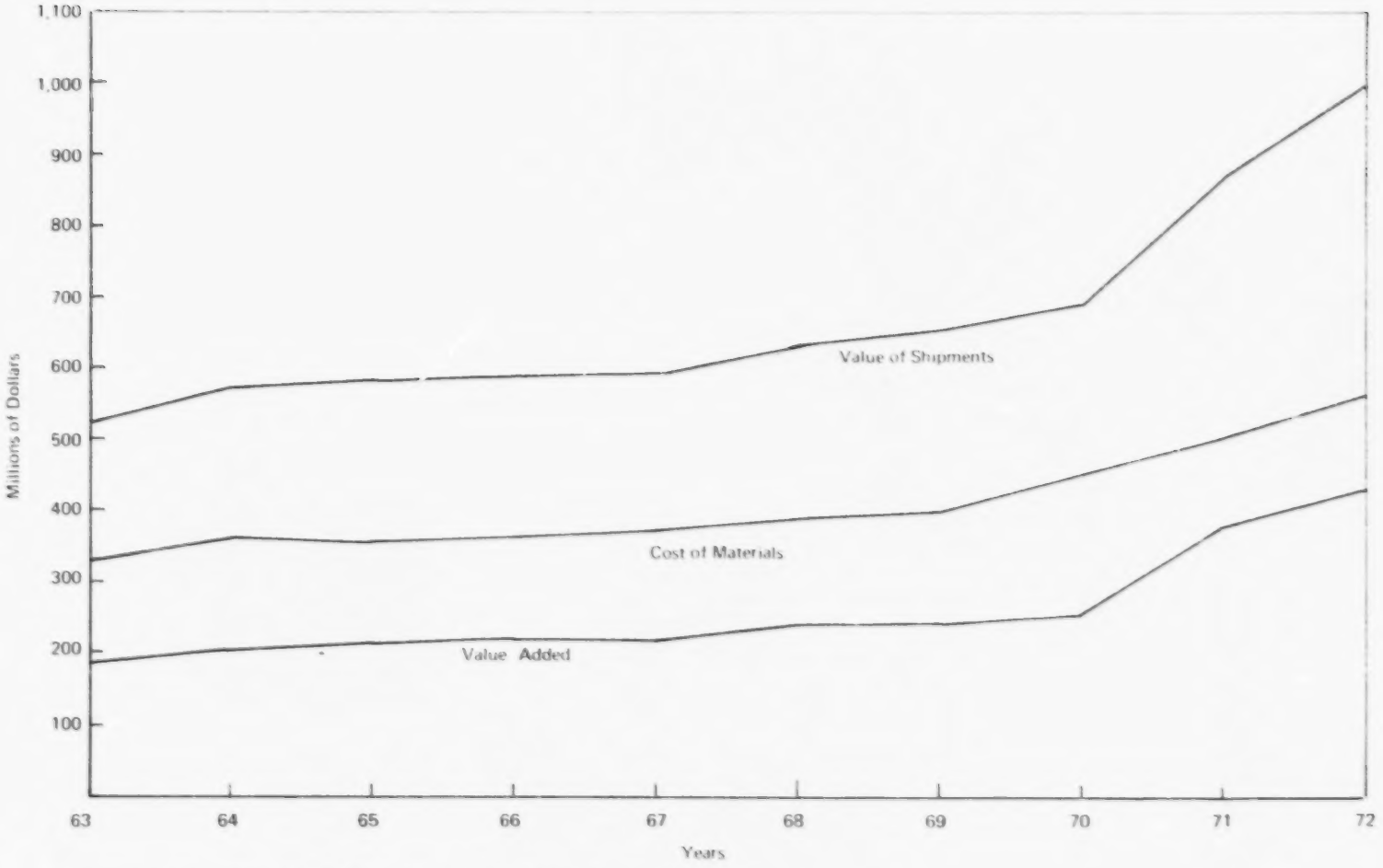
## TABLE II-4

## SIC 2952 – INDUSTRY OPERATING PROFILE

| Year | All Employees | | Production Workers | | | Value Added | Cost of Materials | Value of Shipments | Capital Expenditures | End-of-Year Inventories |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number (000) | Payroll ($Mil.) | Number (000) | Man-Hours ($Mil.) | Wages ($Mil.) | ($Mil.) | ($Mil.) | ($Mil.) | ($Mil.) | ($Mil.) |
| 1963 | 14.6 | 82.5 | 10.9 | 23.0 | 57.3 | 190.0 | 339.0 | 527.6 | 7.0 | 43.0 |
| 1964 | 14.6 | 87.1 | 10.9 | 23.8 | 61.3 | 207.2 | 364.7 | 573.4 | 8.7 | 44.3 |
| 1965 | 14.7 | 89.2 | 11.0 | 23.5 | 65.3 | 219.0 | 364.3 | 585.0 | 10.9 | 42.6 |
| 1966 | 14.7 | 91.3 | 10.7 | 23.0 | 65.8 | 226.3 | 366.1 | 589.4 | 9.6 | 48.5 |
| 1967 | 14.4 | 96.3 | 10.4 | 22.9 | 66.2 | 221.1 | 373.8 | 597.8 | 8.8 | 42.4 |
| 1968 | 14.0 | 102.8 | 10.1 | 22.9 | 70.8 | 241.5 | 394.3 | 633.4 | 13.1 | 46.2 |
| 1969 | 13.8 | 109.5 | 9.9 | 23.3 | 75.5 | 249.2 | 404.7 | 654.7 | 8.8 | 47.6 |
| 1970 | 14.2 | 114.8 | 10.2 | 23.0 | 78.3 | 259.9 | 431.5 | 691.2 | 11.8 | 50.1 |
| 1971 | 14.4 | 127.8 | 10.4 | 23.7 | 87.3 | 376.1 | 508.0 | 879.8 | 15.8 | 54.8 |
| 1972 | 15.6 | 147.6 | 11.2 | 26.4 | 102.6 | 439.4 | 571.0 | 1004.5 | 20.4 | 64.8 |

| Year | Ratio of Value Added to Shipments | Ratio of Inventories to Shipments | Ratio of Payroll to Value Added | Value of Shipments Per Prod. Worker | Man-Hours Per Production Worker | Wage Per Production Worker Man-Hour | Value Added Per Prod. Worker Man-Hour | Index of Employment | Index of Value Added | Index of Shipments |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ($000) | (000) | ($) | ($) | (1967=100) | (1967=100) | (1967=100) |
| 1963 | .360 | .082 | .434 | 48.4 | 2.110 | 2.491 | 8.26 | 101.39 | 85.93 | 88.26 |
| 1964 | .361 | .077 | .420 | 52.6 | 2.183 | 2.576 | 8.71 | 101.39 | 93.71 | 95.92 |
| 1965 | .374 | .073 | .407 | 53.2 | 2.136 | 2.779 | 9.32 | 102.08 | 99.05 | 97.86 |
| 1966 | .384 | .082 | .403 | 55.1 | 2.150 | 2.861 | 9.84 | 102.08 | 102.35 | 98.59 |
| 1967 | .370 | .071 | .436 | 57.5 | 2.202 | 2.891 | 9.66 | 100.00 | 100.00 | 100.00 |
| 1968 | .381 | .073 | .426 | 62.7 | 2.267 | 3.092 | 10.55 | 97.22 | 109.23 | 105.96 |
| 1969 | .381 | .073 | .439 | 66.1 | 2.354 | 3.240 | 10.70 | 95.83 | 112.71 | 109.52 |
| 1970 | .370 | .072 | .442 | 67.8 | 2.255 | 3.404 | 11.30 | 98.61 | 117.65 | 115.62 |
| 1971 | .427 | .062 | .340 | 84.6 | 2.279 | 3.694 | 15.87 | 100.00 | 170.10 | 147.17 |
| 1972 | .437 | .065 | .336 | 89.7 | 2.357 | 3.886 | 16.64 | 108.33 | 198.73 | 168.03 |

**Source:** Bureau of Census, 1971 Survey and 1972 Preliminary Census of Manufactures.




**Source:** Bureau of Census, 1971 Survey and 1972 Preliminary Census of Manufactures

**FIGURE II-1 SIC 2952-INDUSTRY OPERATING PROFILE**

- The ratio of inventory to shipments has been decreasing.

- Capital expenditures totalled $20.4 million in 1972 (up from $15.8 million in 1971), equivalent to $1 of added investment for $50 of shipments.

Tables II-5 and II-6 show the general industry statistics on a four-regional basis for 1967 and 1972. The North Central region, with 39% of total industry shipments, was the most significant in 1967, but a larger proportion of facilities (33%) is located in the South than in any other region, and that region represented the largest proportion (35%) of industry shipments by 1972. Establishments were distributed as follows in 1967 by average number of employees:

9 employees or less – 55
10-19 employees – 33
20-49 employees – 46
50-99 employees – 44
100-249 employees – 42
250 employees and over – 6

In 1967, materials and supplies consumed by the asphalt, felts and coatings industry totalled $317.3 million, increasing to $495.4 million in 1972 (Tables II-7 and II-8).

Roofing plants in this industry range in size from 25,000 to 200,000 tons/year, with the average at about 80,000 tons/year.

b. Firm Characteristics

Of the 226 establishments operating in 1967* 153 were multi-unit companies and 192 were public corporations (Table II-9). The industry has traditionally been characterized as one of family-owned companies with regional concentrations but a considerable number of acquisitions and mergers have taken place over the past decade. For example, Bird & Son acquired the West Coast facilities of Fiberboard Inc. in 1968; Jim Walter Corporation now owns and operates the five roofing plants and associated dry felt facilities of the Phillip Carey Manufacturing Company, as well as the nine roofing plants and six dry felt plants that were once part of the Barrett Company and itself is now a part of the Celotex Corporation; Certain-teed Products Corporation operates nine roofing plants, including that of the B.F. Nelson Company; and the GAF Corporation owns and operates the previous Ruberoid facilities. The number of operating companies has decreased from 126 in 1963, to 115 in 1967 and about 100 today.

* 1972 Census data on these characteristics are, as yet, unavailable.

TABLE II 5

GENERAL STATISTICS, BY GEOGRAPHIC AREAS: 1967

| | Establishments | | All Employees | | Production Workers | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | With 20 employees or more | Number* | Payroll** | Number* | Manhours+ | Wages** | Value added by manufacture** | Cost of materials** | Value of Shipments** | Capital expenditures, New** |
| United States | 226 | 138 | 14.4 | 96.3 | 10.4 | 22.9 | 66.2 | 221.1 | 373.8 | 597.8 | 8.8 |
| Region | | | | | | | | | | | |
| Northeast | 44 | 27 | 2.6 | 18.7 | 2.0 | 4.4 | 13.4 | 41.7 | 79.1 | 120.6 | 1.9 |
| North Central | 65 | 42 | 5.6 | 39.9 | 4.4 | 9.7 | 29.2 | 89.1 | 139.8 | 230.8 | 3.2 |
| South | 75 | 49 | 4.7 | 27.6 | 3.0 | 6.6 | 16.8 | 69.3 | 110.6 | 179.9 | 2.0 |
| West | 42 | 20 | 1.5 | 10.1 | 1.0 | 2.2 | 6.9 | 21.0 | 44.2 | 66.5 | 1.7 |

* Thousands
** Millions of dollars
+ Millions

Source: Bureau of Census, 1967 Census of Manufactures

TABLE II-6

GENERAL STATISTICS, BY GEOGRAPHIC AREAS: 1972

| | Establishments | | All Employees | | Production Workers | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | With 20 employees or more | Number* | Payroll** | Number* | Manhours+ | Wages** | Value added by manufacture** | Cost of materials** | Value of Shipments** | Capital expenditures, New** |
| **United States** | 233 | 139 | 15.6 | 147.6 | 11.2 | 26.4 | 102.6 | 439.4 | 571.0 | 1004.5 | 20.4 |
| **Region** | | | | | | | | | | | |
| Northeast | 41 | 20 | 2.6 | 26.6 | 1.7 | 4.8 | 19.4 | 76.5 | 110.0 | 185.6 | 3.9 |
| North Central | 67 | 44 | 5.6 | 54.2 | 4.3 | 9.7 | 40.1 | 149.5 | 193.4 | 339.8 | 9.0 |
| South | 80 | 54 | 5.6 | 48.2 | 3.9 | 9.0 | 30.3 | 154.1 | 194.1 | 347.2 | 5.4 |
| West | 45 | 21 | 1.8 | 18.6 | 1.3 | 2.9 | 12.8 | 59.3 | 73.5 | 131.9 | 2.1 |

*Thousands
**Millions of dollars
+Millions

**Source:** Bureau of Census, 1972 Preliminary Census of Manufactures.

TABLE II-7

MATERIALS CONSUMED IN THE MANUFACTURE OF ASPHALT FELTS AND COATINGS, 1967

| Material | Unit | Quantity | Delivered Value* |
|---|---|---|---|
| Asphalt | | | |
| Less than 200 penetration | 1000 short tons | 3213.6 | 64.5 |
| 200 and over penetration | million barrels | 9.1 | 27.6 |
| Unsaturated roofing felts, other construction paper and insulating board | 1000 short tons | 1535.3 | 81.9 |
| Roofing granules | 1000 short tons | 1895.9 | 47.9 |
| Sand and Gravel | 1000 short tons | 578.4 | 3.1 |
| All other | – | – | 92.3 |
| Total | – | – | 317.3 |

*Millions of dollars

**Source**: Bureau of Census, 1967 Census of Manufactures.

TABLE II-8

MATERIALS CONSUMED IN THE MANUFACTURE OF ASPHALT FELTS AND COATINGS, 1972

| Material | Unit | Quantity | Delivered Value* |
|---|---|---|---|
| Asphalt | | | |
| Less than 200 penetration | 1000 short tons | 4281.0 | 122.8 |
| 200 and over penetration | million barrels | 12.8 | 41.1 |
| Unsaturated roofing felts, other construction paper and insulating board | 1000 short tons | 1524.3 | 124.6 |
| Roofing granules | 1000 short tons | 2730.8 | 77.0 |
| Sand and Gravel | 1000 short tons | 771.4 | 6.7 |
| All other | – | – | 123.2 |
| Total | – | – | 495.4 |

*Millions of Dollars

**Source**: Bureau of Census, 1972 Preliminary Census of Manufactures.

TABLE II-9

SELECTED STATISTICS FOR OPERATING MANUFACTURING ESTABLISHMENTS, BY TYPE OF OPERATION AND LEGAL FORM OF ORGANIZATION FOR MAJOR INDUSTRY GROUPS AND INDUSTRIES: 1967

| | Establishments | | All Employees | | Production Workers | | | Value added by manufacture** | Cost of materials** | Value of Shipments** | Capital expenditures, New** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | With 20 employees or more | Number* | Payroll** | Number* | Man-hours+ | Wages** | | | | |
| Asphalt felts & coatings | | | | | | | | | | | |
| Total | 226 | 138 | 14.4 | 96.3 | 10.4 | 22.0 | 66.2 | 221.1 | 373.8 | 597.8 | 8.8 |
| Multiunit companies | | | | | | | | | | | |
| Total | 153 | 114 | 12.4 | 84.4 | 9.2 | 20.3 | 59.6 | 192.5 | 336.3 | 532.0 | 7.8 |
| Single unit companies | | | | | | | | | | | |
| Total | 45 | 24 | 1.9 | 11.4 | 1.2 | 2.6 | 6.3 | 27.5 | 35.6 | 62.9 | (D) |
| Corporate | 192 | 136 | 14.2 | 95.2 | 10.3 | 22.7 | 65.5 | 218.6 | 370.3 | 591.9 | (D) |
| Noncorporate | | | | | | | | | | | |
| Total | 6 | 2 | .1 | .6 | .1 | .1 | .4 | 1.4 | 1.7 | 3.0 | (D) |

*Thousands
**Millions of Dollars
+Millions
(D) Not Disclosed

Source: Bureau of Census, 1967 Census of Manufactures.

Despite these changes in industry structure, the concentration ratios have varied little over the past decade. Currently, the four largest companies share approximately 38% of industry shipments and the eight largest, 65%. About the same ratios existed in 1963 and 1967, with about 86% of shipments coming from the 20 largest companies and 97% from the 50 largest. Currently, the company with the largest total number of facilities in the industry, and also one of the larger in terms of market share, is an independent, privately-owned corporation, the Lloyd A. Fry Roofing Company of Summit, Illinois. In addition, a large number of privately owned and operated companies are still significant factors in the industry in both the felts and coatings segments.

c. Industry Segmentation

Plants manufacturing roofing felts and impregnated roofing felts utilize process water; those producing roofing asphalts, pitches and cements do not. According to the Development Document, the amount of water used does not depend on the size or age of the plant but on the type of process employed to cool the saturated asphalt roofing felts. A splash-type cooling process uses 250,000 gallons of water per day for an average production of 500 short tons, as compared to 100,000 gallons per day for a fine spray or mist-type cooling system.

Treatment of the types of waste water generated at all these plants will apparently be independent of age and geographic location but economies of scale are a factor when considering waste water quantities. Thus, smaller plants will face greater relative investment and operating costs for treatment technology; the Development Document has taken this fact into account in defining three different levels of operation (200, 500 and 700 tons/day) in estimating these costs.

Further differences in the investment and operating cost structure occur in the roofing industry depending on the existence, or not, of oxidation towers and on the product mix at a particular location. In the former case, the current value of assets could be higher; in the latter, unit operating costs and selling prices are higher for prepared roofing than for roll roofing.

3. Financial Profile

Manufacturing plants in this industry vary considerably by size but even more significantly by net asset value. The oldest operating facility was built about 80 years ago and is currently operated with equipment at least 30 years old. Its net asset value is thus considerably less than $1 million; newer facilities have assets of up to $6 million. The average book value for all 108 plants is about $2.2 million. The construction of a new 150,000-ton/year plant in 1974 would cost less than $3 million for a basic facility and as much as $3.5-4 million for a plant without oxidation equipment, and $6 million for one that included oxidation equipment, pollution control and rail facilities.

The income statement for a typical plant would be similar to that shown in Table II-10. A typical plant, with a daily capacity of 500 tons and net assets of about $2.5 million, will produce an average of 120,000 tons of roofing products each year. The average net price in 1973, after discounts and freight, was $80 per ton; the average for 1974 is expected to be at least $90. In terms of both net profit after tax and returns on net assets, a roofing plant is a relatively profitable operation. A smaller plant concentrating in the production of roll roofing could achieve net returns on sales as high as 10% as significant operating efficiencies and a minimum of product spoilage is achieved. However, it should be pointed out that on a discounted cash flow basis the return on investment for a new mill will be considerably lower than the 15-20% for an existing facility and could be 10-12% at today's cost of capital.

**TABLE II-10**

**INCOME STATEMENT – TYPICAL PLANT, 1973***

| | % | $MM |
|---|---|---|
| Net Sales | 100 | 9.6 |
| Cost of Goods Sold | 75 | 7.2 |
| Operating Profit | 25 | 2.4 |
| General, Sales and Admin. Expenses | 15 | 1.4 |
| Net Profit Before Tax | 10 | 1.0 |
| Net Profit After Tax | 5 | 0.5 |
| Return on Net Assets | 15-20 | – |

*Net Assets $2.5-3.0 million.

**Source**: Contractor Estimates.

Consequently, risk capital for a new mill is a serious problem for roofing companies. Moderate capital requirements to improve existing facilities by modernization or by adding environmental control equipment is highly likely but the expansion of existing facilities is a much more complex question that involves the availability of dry felt, land utilization in what normally is a constricted site, regional competition, etc. If the industry continues to grow as anticipated, new facilities will be needed in the near future for the rapidly growing regions of the United States, such as the South and Southwest. However, there is a definite reluctance at this time to commit the required investments and the current shortages of roofing materials may continue until the anticipated return on investment for a new facility is attractive enough.

The time that this will occur is difficult to assess because so many factors – prices, demand, manufacturing costs and capital costs – are extremely volatile in 1974. Price controls have, in fact, created an artificial situation in the industry. At a time of strong

demand, prices were not permitted to respond freely to market pressures and returns on investment were less than might have otherwise been the case. As capacity utilization rates now reach a maximum, the prospect of the current short-term shortages' becoming extended is a distinct possibility because the industry has not enjoyed sufficiently high returns on new investment to attract new capacity. However, prices have increased rapidly since the beginning of 1974 and, as long as costs exhibit a slower rate of increase and demand remains high, those companies with a favorable debt-equity ratio are likely to add capacity.

### 4. Prices and Price Setting

Wholesale prices for prepared asphalt roofings, the only product for which such indices are available, are shown in Table II-11. Actual prices have increased by a total of 40% from 1963 to 1972, and by 12% relative to the All Commodities Price Index (all this real increase occurring in 1971-72). It is notable that, despite the small proportion total consumption of prepared asphalt roofing represented by new residential roofing, the years of low housing starts (1964, 1967 and 1970) depressed the price index, suggesting that the new housing increment is a significant marginal contributor to profit.

**TABLE II-11**

**WHOLESALE PRICE INDEX FOR PREPARED ASPHALT ROOFING**
**(1967=100)**

| | Actual | Relative* |
|---|---|---|
| 1963 | 94.9 | 100.4 |
| 1964 | 93.7 | 98.9 |
| 1965 | 98.0 | 101.4 |
| 1966 | 102.6 | 102.8 |
| 1967 | 100.0 | 100.0 |
| 1968 | 104.0 | 101.5 |
| 1969 | 105.8 | 99.3 |
| 1970 | 101.8 | 92.2 |
| 1971 | 126.5 | 111.1 |
| 1972 | 133.4 | 112.0 |
| 1973 | 138.3 | — |

*Relative to the All-Commodities Price Index.

**Source**: U.S. Department of Commerce, *Construction Review*, April 1974

Historically, the price for built-up roofing (used principally on non-residential construction) probably has been more stable than that for prepared asphalt roofing, although the products are generically similar, built-up roofing does not have the variations of color, style, brand, etc., that is apparent with residential roofing materials.

Manufacturers publish dealer price lists on a three-region basis – West, Mountain and east of the Rockies. These price lists may contain 10 to 30 different items and will be quoted on a per-square or per-roll basis. Truckload or carload lots are usually shipped at full list prices to dealer categories, such as cash-and-carry, building materials yards, and some contractors who carry stock, but there is room for negotiation. Wholesalers are eligible for discounts of 5% plus 5% for the West and Mountain regions and 7% plus 7% for east of the Rockies. Individual manufacturers set their own prices but with the severe intra-regional competition, price lists are frequently similar and quotations can be equalized.

Over the past year, manufacturers have been faced with considerable price increases for basic raw materials and have had to revise price lists frequently. For example, recent increases in the price of asphalt, from $25 per ton in October 1973 to the current price of nearly $80, have resulted in as many as three revised price bulletins in the same period and all in compliance with Phase IV Wage and Price Control regulations.

## B. PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS

The Development Document has proposed effluent limitations for a typical plant using 150,000 gallons of process water per day and producing 500 short tons of product per day (Table II-12).

**TABLE II-12**

**EFFLUENT LIMITATIONS FOR ASPHALT ROOFING PLANTS**
**(500 Tons/Day)**

| | Suspended Solids* | |
|---|---|---|
| | 30-day Average (lb/1000 lb) | Maximum Daily (lb/1000 lb) |
| Best Practicable Control Technology Currently Available (1977) | 038 | 056 |
| Best Available Technology Economically Achievable (1983) | 019 | 028 |
| Standards of Performance for New Sources | 019 | 028 |

Note: pH within the range of 6.0 to 9.0

*Limits are based on weight of pollutant per weight of product produced.

**Source**: Development Document.

The majority of asphalt roofing plants are already removing part of the suspended solids from their waste water before discharging it, or are discharging into municipal systems. It is estimated that about 60% of facilities use municipal systems, 5% require BAT only, and a further 35% require both BPT and BAT. According to the Development Document, performance standards for new sources (PSNS) are the same as the pollution reduction achieved by applying BAT technology and the costs are identical. The Guidelines contractor has thus estimated the investment and annual operating costs for BPT and BAT conditions:

- At the majority of plants, large suspended materials are settled in a pretreatment type pond or detention sump before the effluent is discharged. BPT requires that all plants employ primary settling. The costs of BPT have been developed for situations in which either an earthern stilling basin is installed or a steel or concrete settling tank is used. It is assumed that both are cleaned monthly by manual methods. It is also assumed that sprays or mists are installed to reduce the volume of waste water.

- BAT requires that coagulants be used to settle out more suspended solids. Because larger quantities are settled out, the costs of applying BAT allow for expenses incurred in having the resulting sludge removed continuously and mechanically. It is assumed, therefore, that the earthen stilling basin which is acceptable under BPT is replaced by a settling tank.

The treatment costs associated with both systems for the average, small and large plants are shown in Tables II-13, -14, and -15.

## C. ECONOMIC IMPACT ANALYSIS

### 1. Price Effects

Assuming an average base selling price of $80 per short ton of shipments, the incremental price increase that would be required to maintain curent returns on net assets and, at the same time, pass on the costs of meeting BPT Guidelines would be equivalent to the following:

| | Earthen Stilling Basin | Tank |
|---|---|---|
| | (%) | (%) |
| Small Plant (200 Tons/day) | .06 | .23 |
| Average Plant (500 Tons/day) | .04 | .11 |
| Large Plant (700 Tons/day) | .04 | .10 |

**TABLE II-13**

**TREATMENT COSTS – ASPHALT ROOFING PLANTS**
**(Small Plant – 200 tons/day x 250 days/year)**

| Type of Cost | BPT (1977) | BAT* (1983) | NSPS |
|---|---|---|---|
| | | (Earthen Stilling Basin Solution) | |
| Total Investment | $ 3,500 | $40,500 | $ N.A. |
| Total Operating, Maintenance & Energy | 1,075 | 7,750 | N.A. |
| Total Yearly** | 1,775 | 15,850 | N.A. |
| Cost/Short Ton | 0.04 | 0.32 | N.A. |
| | | (Tank Solution) | |
| Total Investment | 20,000 | 37,000 | 37,000 |
| Total Operating, Maintenance & Energy | 1,100 | 5,250 | 5,250 |
| Total Yearly** | 5,100 | 12,650 | 12,650 |
| Cost/Short Ton | 0.10 | 0.25 | 0.25 |

*Cumulative costs incurred after BPT has been achieved.

**Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). 15% was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

N.A. – Not applicable.

**Source**: Development Document and Guidelines Contractor

The equivalent selling price increases to meet BAT and NSPS treatment requirements would be:

| | Earthen Stilling Basin (¢) | Tank (¢) |
|---|---|---|
| Small Plant (200 Tons/day) | .58 | .49 |
| Average Plant (500 Tons/day) | .33 | .30 |
| Large Plant (700 Tons/day) | .30 | .26 |

These price increases, due solely to the effects of achieving effluent limitations by 1983, must be evaluated against price increases for asphalt roofing materials that averaged 4% in 1973 and up to 10% in the first five months of 1974. While a plant can obviously choose to absorb some or all of the incremental costs, it is concluded that full costs will be passed through and that the resulting price increases will be achieved by an industry that has

**TABLE II-14**

**TREATMENT COSTS – ASPHALT ROOFING PLANTS**
**(Typical Plant – 500 tons/day x 250 days/year)**

| Type of Cost | BPT (1977) | BAT* (1983) | NSPS |
|---|---|---|---|
| | (Earthen Stilling Basin Solution) | | |
| Total Investment | $ 5,125 | $55,125 | $ N.A. |
| Total Operating, Maintenance & Energy | 1,700 | 12,075 | N.A. |
| Total Annual** | 2,725 | 23,100 | N.A. |
| Cost/Short Ton | 0.02 | 0.18 | N.A. |
| | (Tank Solution) | | |
| Total Investment | 24,000 | 53,500 | 53,500 |
| Total Operating, Maintenance & Energy | 1,910 | 9,690 | 9,690 |
| Total Annual** | 6,710 | 20,390 | 20,390 |
| Cost/Short Ton | 0.05 | 0.16 | 0.16 |

*Cumulative costs incurred after BPT has been achieved.

**Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). 15% was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

N.A. – Not applicable

**Source:** Development Document.

enjoyed favorable returns on current net assets and a steady increase in market growth over the past few years. In addition, the short-term capacity shortage situation and concomitant price increases will reinforce the industry's ability to pass on BPT costs. Even allowing for the normal economies of scale in treatment costs that work to the advantage of larger plants, the price impact on the smaller facilities will still be relatively insignificant and passed on, along with other cost increases.

2. Financial Effects

Although it is a very unlikely possibility, one can assume that prices are not increased and that the incremental costs of effluent pollution control, rather than being passed through, are absorbed. The resulting effect on profitability would be a maximum reduction in net profit after tax of $23,100 (average plant; earthen stilling basin solution; BAT) on an average profit of $500,000 for the typical plant. In other words, the maximum reduction in the return on current net assets would be about 0.8% on a base of 15-20%.

TABLE II-15

TREATMENT COSTS – ASPHALT ROOFING PLANTS
(Large Plant – 700 tons/day x 250 days/year)

| Type of Cost | BPT (1977) | BAT* (1983) | NSPS |
|---|---|---|---|
| | (Earthen Stilling Basin Solution) | | |
| Total Investment | $ 7,500 | $67,500 | $ N.A. |
| Total Operating, Maintenance & Energy | 2,125 | 16,625 | N.A. |
| Total Yearly** | 3,625 | 30,125 | N.A. |
| Cost/Short Ton | 0.02 | 0.17 | N.A. |
| | (Tank Solution) | | |
| Total Investment | 30,000 | 62,000 | 62,000 |
| Total Operating, Maintenance & Energy | 2,750 | 12,100 | 12,100 |
| Total Yearly** | 8,750 | 24,500 | 24,500 |
| Cost/Short Ton | 0.05 | 0.14 | 0.14 |

*Cumulative costs incurred after BPT has been achieved.

**Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). 15% was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

N.A. – Not applicable

**Source:** Development Document and Guidelines Contractor

Capital availability to meet the effluent control requirements should also present no problem. The total cumulative investment required by the average-sized roofing plant by 1983 is $55,000, equivalent to about 2.5% of the net asset value for the average plant, and that for the largest sized plant, $67,500. By way of comparison, annual capital expenditures by the industry over the past five years averaged $14.5 million ($135,000/plant) and totalled $20.4 million in 1972. For the 108 plants in the United States that produce dry and saturated roofing felts, the total capital investment required by 1983 aggregates to approximately $3.5 million, in comparison to the initial capital investment of $6 million required to construct a 600-ton-per-day plant equipped with oxidation, pollution control and rail facilities.

It is concluded that the capital requirements to implement the effluent control regulations are entirely reasonable and well within the capabilities of the industry and its individual companies to provide. No economic impact is anticipated as a result.

### 3. Production Effects

The current level of production and the future rate of growth of the asphalt roofing industry probably will not be affected by the implementation of the proposed effluent control Guidelines. No plants will be forced to close or to reduce their current level of operation.

### 4. Employment Effects

No employment effects will result from the proposed effluent limitations Guidelines.

### 5. Community Effects

No community effects are anticipated from the proposed effluent limitations Guidelines.

### 6. Balance of Trade Effects

The current relationships between export and import of asphalt roofing materials will not be altered as a result of implementing the proposed effluent limitations guidelines.

## PART III: ASPHALT-FELT BASE FLOOR COVERINGS (SIC 3996)

### A. INDUSTRY STRUCTURE

#### 1. Products and Demand

##### a. Products

The generic description of SIC 3996 products is "Linoleum, Asphalted Felt-Base, and Other Hard Surface Floor Coverings, Not Elsewhere Classified." Included within the full classification are the following products:

- Carpets, asphalted-felt-base (linoleum).
- Floor coverings, asphalted-felt-base (linoleum).
- Hard surface floor coverings, expect rubber and cork.
- Linoleum
- Tile, floor: supported plastic

This floor covering product mix may be divided into three major categories: tile, inlaid sheet, and non-permanent sheet. While the first two were traditionally installed with an adhesive, a study of the market indicates that almost all asphalt-based floor products are considered by consumers to be "temporary flooring" and are not affixed by a mastic or adhesive. This attitude may be associated with the relative short product life expectancy and low product price.

Tile is usually supplied in squares of specific sizes (usually in 9" x 9" to 12" by 12");however rectangular and diamond patterns are available in the market in small amounts. Linoleum and rolled goods are available in 6', 9', and 12' widths. Some linoleum and rolled products are manufactured with a border on two sides, while others have no border.

This analysis is concerned solely with plants engaged in the production of linoleum and asphalt printed felt floor coverings, since effluent limitations guidelines are being written solely for those segments of SIC 3996.

Linoleum may be characterized by a relatively thick wearing surface, extending to a backing of burlap, cotton fabric, or felt. Although there are many chemical compound matrixes, only printed asphalt felt material has been analyzed.

Asphalt printed felts are not considered *true* linoleums by manufacturers, but are sold under the generic name of linoleum. Substitute inlaid sheet products which have almost completely replaced the asphalt felt-based "linoleum" are solid vinyl (PVC polyvinyl chloride sheet) and cushioned-back solid vinyl (not permanently affixed by adhesive).

b. Manufacturing Processes

The manufacturing processes have been described in the Development Document and no further treatment will be given here.

c. Production and Shipments

Shipments of all products in SIC 3996 (Table III-1) have increased moderately in recent years at about 2%/year in current dollars, 1958-1971, and with an additional 32% increase to 1972. Research suggests that there has been a dramatic decrease in the production of the asphalt-based floor products under consideration and a commensurate increase in shipments of other products, such as supported plastic tile, included within the sector.

TABLE III-1

VALUE OF SHIPMENTS OF HARD SURFACE FLOOR COVERINGS
(millions of dollars)

| | |
|---|---|
| 1958 | 181.6 |
| 1959 | 206.5 |
| 1960 | 183.8 |
| 1961 | 179.7 |
| 1962 | 191.3 |
| 1963 | 204.1 |
| 1964 | 217.6 |
| 1965 | 227.8 |
| 1966 | 230.3 |
| 1967 | 221.7 |
| 1968 | 230.3 |
| 1969 | 235.1 |
| 1970 | 232.6 |
| 1971 | 258.8 |
| 1972 | 341.5 |

**Source:** U.S. Bureau of Census; Annual Surveys and Censuses of Manufactures.

According to Poor's Register, 13 manufacturing companies are listed under SIC 3996 with the Census Bureau identifying 18 establishments operating in 1972. However, inquiries revealed that most smaller companies have discontinued manufacturing asphalt-based flooring or have been acquired by larger multi-line flooring manufacturers. Research indicates that only one manufacturing facility (that of Armstrong Cork) manufactures asphalt-based linoleum flooring and this plant is gradually being phased out of production and converted to vinyl flooring production. A similar reduction in production is apparent for asphalt printed felts, with only two companies (Carthage Mills, Cincinnati, Ohio and Mannington Mills, Salem, New Jersey) still in production. Shipments of asphalt-felt-base and linoleum floor coverings declined from $30.8 million in 1967, to $15.1 million in 1972.

d. Markets and Future Growth

The market for asphalt-based flooring products derives from a very limited demand for an extremely low-cost product having short life expectancy. This mass market may be characterized as the "bottom of the line" segment and represents a very minor (2-3%) portion of the total flooring market. Apparent historic demand has come from economically deprived areas (rural, especially in the Southeast) and from inexpensive second home dwellings, etc. This demand is expected to become non-existent within about three years as consumer acceptance of vinyl and vinyl asbestos flooring increases. Lower costs resulting from economies of scale and technical innovations for competing products will help to eliminate demand for asphalt-based flooring. Furthermore, the price of refined asphalt feedstock has increased considerably recently and the feedstock is in short supply, thus increasing the relative cost of asphalt flooring. Consequently, asphalt's single market advantage, low cost, is rapidly disappearing and with it the only justification for continued significant production of the product.

e. Marketing and Distribution

The product is not marketed aggressively and no significant advertising or promotion is discernible, except as a store attraction.

Distribution patterns, where demand exists, are dictated by analogous product flow. Batch-run quantities produced by local asphalt specialities manufacturers are warehoused and shipped (usually locally) when demand requires. The product is marketed mainly through retail outlets as a "bottom-of-line" commodity. Since consumers identify the product as a "temporary" flooring product, it is being replaced gradually by low-cost carpeting.

2. Manufacturing Profile

a. Firm Characteristics

Inquiries revealed that very few companies still manufacture linoleum or asphalt felt-based floorings. It appears that only one company – Armstrong Cork – is still producing linoleum, and it will cease this production in the very near future. Only two manufacturers still produce felt based products, after New London Mills ceased production in July 1973.

b. Plant Characteristics

No published plant data is available on the specific products under consideration but Table III-2 summarizes information on the total SIC sector. These data indicate a drop in total employment from 8000 workers in 1958 to 5200 in 1971 – equivalent to a decrease of 3.3%/year – with a slight increase in 1972. Capital expenditures per dollar of shipments have been relatively low and were only 4.1¢ in 1972.

TABLE III 2

SIC 3996 – INDUSTRY OPERATING PROFILE

| Year | All Employees | | Production Workers | | | Value Added ($Mil.) | Cost of Materials ($Mil.) | Value of Shipments ($Mil.) | Capital Expenditures ($Mil.) |
|---|---|---|---|---|---|---|---|---|---|
| | Number (000) | Payroll ($Mil.) | Number (000) | Man Hours ($Mil.) | Wages ($Mil.) | | | | |
| 1958 | 8.0 | 41.9 | 6.7 | 14.0 | 34.1 | 93.1 | 87.1 | 181.6 | 5.4 |
| 1959 | 8.0 | 44.8 | 6.8 | 14.3 | 36.3 | 110.9 | 97.5 | 206.5 | 9.5 |
| 1960 | 7.1 | 39.7 | 5.8 | 11.8 | 31.1 | 96.1 | 83.9 | 183.8 | 7.8 |
| 1961 | 6.6 | 38.2 | 5.3 | 10.8 | 29.4 | 96.9 | 79.5 | 179.7 | 5.7 |
| 1962 | 6.4 | 39.4 | 5.3 | 11.0 | 30.6 | 110.7 | 82.8 | 191.3 | 5.0 |
| 1963 | 6.2 | 39.0 | 5.0 | 10.1 | 29.5 | 115.8 | 80.7 | 204.1 | 4.4 |
| 1964 | 6.3 | 42.3 | 5.1 | 10.7 | 32.3 | 132.5 | 86.4 | 217.7 | 6.8 |
| 1965 | 6.2 | 42.3 | 5.0 | 10.4 | 32.4 | 139.2 | 89.2 | 227.8 | 10.0 |
| 1966 | 6.3 | 44.8 | 5.1 | 10.8 | 34.4 | 135.2 | 100.8 | 230.3 | 9.3 |
| 1967 | 6.0 | 43.5 | 4.9 | 10.1 | 33.2 | 133.4 | 90.4 | 221.7 | 20.6 |
| 1968 | 5.8 | 43.9 | 4.6 | 9.4 | 33.1 | 140.2 | 90.6 | 230.3 | 7.7 |
| 1969 | 5.5 | 45.6 | 4.4 | 9.1 | 34.4 | 132.7 | 101.7 | 235.1 | 10.5 |
| 1970 | 5.4 | 46.5 | 4.2 | 9.0 | 35.0 | 139.5 | 97.9 | 232.6 | 14.5 |
| 1971 | 5.2 | 48.6 | 4.1 | 8.6 | 36.2 | 159.1 | 100.5 | 258.8 | 20.7 |
| 1972 | 5.8 | 59.4 | 4.5 | 9.7 | 44.7 | 211.5 | 134.9 | 341.5 | 14.0 |

**Source**: Bureau of Census, 1971 Survey and 1972 Preliminary Census of Manufactures.

### 3. Prices and Price Setting

FOB prices for felt-based floor coverings range from 5¢ to 10¢ per square foot; that for linoleum averages about 30¢. Assuming a felt-based density of 130 lb/cubic foot, the job selling price averages about $110/short ton. Price setting recognizes the "bottom-of-the-line" image of the products and the relatively poor performance compared to more recent innovations. The products are sometimes used as promotional specials, or traffic builders by discount stores, advertised prices being extremely low and apparently attractive.

## B. PROPOSED EFFLUENT LIMITATIONS, TECHNOLOGIES AND COSTS

The Development Document has proposed effluent limitations for a typical linoleum and asphalt-printed felt plant with a daily capacity of 30 short tons and a waste water flow of 6,000 gallons per day (Table III-3).

**TABLE III-3**

**EFFLUENT LIMITATIONS FOR LINOLEUM AND ASPHALT PRINTED FELT PLANTS**
**(30 short tons/day)**

| | Suspended Solids* | |
|---|---|---|
| | 30-day Average | Maximum Daily |
| | (lb/1000 lb) | (lb/1000 lb) |
| Best Practicable Control Technology Currently Available | 0.025 | 0.038 |
| Best Available Technology Economically Achievable | 0.013 | 0.019 |
| Standards of Performance for New Sources | 0.013 | 0.019 |

Note: pH within the range 6.0 to 9.0
*Limits are based on weight of pollutant per weight of product produced.

**Source**: Development Document.

BPT requires that suspended solids be settled out of the waste water prior to discharge. The cost estimates (Table III-4) assume that a settling tank is installed and that the sludge is manually removed from it at recurring intervals. BAT requires that coagulants be used to increase the amount of suspended materials removed. The costs, also shown in Table III-4, reflect the additional investment and operating expenses that would be incurred. NSPS requirements and their associated costs are identical to BAT technology.

TABLE III 4

TREATMENT COSTS – LINOLEUM AND ASPHALT FELT PLANTS
(Typical Plant – 30 tons/day x 250 days/year)

| TYPE OF COST | BPT (1977) | BAT* (1983) | NSPS |
|---|---|---|---|
| Total Investment | $3600 | $6100 | $6100 |
| Total Operating Maintenance and Energy | 725 | 2595 | 2570 |
| Total Annual | 1445 | 3815 | 3790 |
| Cost/Short Ton | 0.19 | 0.51 | 0.51 |

* Cumulative costs incurred after BPT has been achieved.

** Includes operation and maintenance, energy, and capital cost amortized at 15% discount rate over 10 years (factor of 0.2). Fifteen percent was chosen as a current cost of capital for the industry, although it may vary significantly by plant depending on ownership pattern. The effect of any change in the rate is insignificant for this analysis.

**Source**: Development Document.

## C. ECONOMIC IMPACT ANALYSIS

It is anticipated that base line closures in this sector, independent of the potential economic impact of effluent control Guidelines, will cause this industry to cease production within about two years, and certainly prior to 1977.

Consequently, the examination of the potential economic impact is not meaningful except as a theoretical analysis. The incremental costs of achieving BPT effluent limitations are equivalent to 0.17% of selling prices; the costs for achieving BAT are approximately 0.47%. In the remote possibility that some plants are still in operation in 1983, such price increases are certainly modest enough to be passed through in full with no noticeable effect on the market for the industry's products.

## LIMITS OF THE ANALYSES

This assessment of the potential economic impact of the BPT and BAT effluent guidelines on the asphalt paving and roofing manufacturing industry has been based on the assumption that the unit operations and corresponding typical plant capital investment and annual treatment costs suggested by the Development Document are truly applicable to the effluents generated by the appropriate industry categories. As such, the economic impact conclusions rest on the accuracy of these cost data and treatment schemes.

The evaluation of the economic impact of additional water treatment costs, and particularly the determination of specific plant costs as a proportion of annual sales, is a function of at least three estimated quantities – "annualized" water treatment costs, typical annual production rates, and representative unit sales values of products. Thus, any gross errors in any of these quantities affect the accuracy of the impact parameter. To minimize such errors, careful judgment has been exercised in the estimates and they are believed to be reasonably reflective of actual data.

It needs to be indicated that while the present analysis has identified plants that may be potentially vulnerable as a result of the effluent guidelines, the decision to curtail or discontinue operations at a given plant is governed by a number of interacting factors, while waste water treatment costs may appear unacceptably high at a threatened plant, the decision to continue or terminate operations is a function of corporate goals, present and future market conditions, etc. For example, with 4,800 plants in the asphalt paving industry, it has been necessary to generalize the potential impact on an industry-wide basis. The vulnerability of a specific plant will depend on whether it has a baghouse, is located in a competitive urban location, has good highway access, etc.

Finally, the interpretation of the potential impact of the proposed effluent guidelines has not taken into account the concurrent and reinforcing effects of other future legislations and governmental controls which, with the additional water control costs, may create a "last-straw" effect, on the sectors under consideration, even though the effluent treatment costs may by themselves be negligible.